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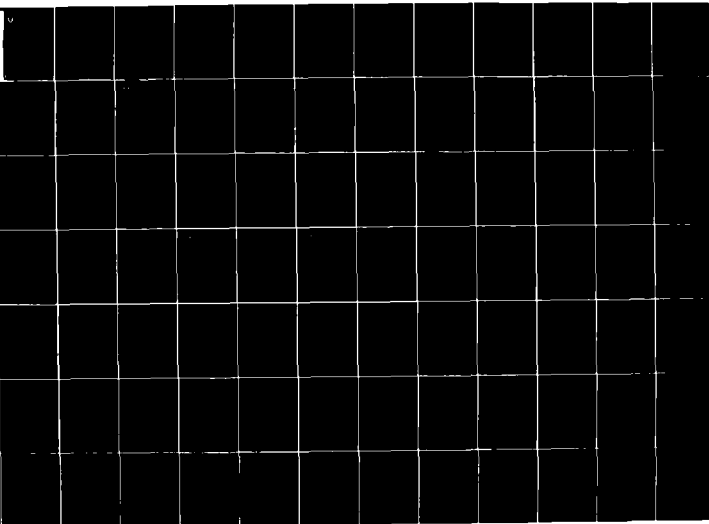
RAYTHEON CO QUINCY MASS INDUSTRIAL COMPONENTS OPERATION F/G 9/1  
MANUFACTURING METHODS AND TECHNOLOGY ENGINEERING (MM AND TE) PR--ETC(11)  
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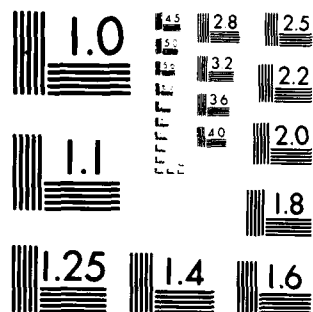
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DELET-TR-76-8119-F-VOL-2 NL

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MICROCOPY RESOLUTION TEST CHART  
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## Research and Development Technical Report

DELET-TR-76-8119-F

MANUFACTURING METHODS AND TECHNOLOGY ENGINEERING  
(MM&TE) PROGRAM FOR THE ESTABLISHMENT OF PRODUCTION  
TECHNIQUES FOR HIGH DENSITY THICK FILM CIRCUITS  
USED IN CRYSTAL OSCILLATORS

VOLUME II

R. Michel Zilberstein

RAYTHEON COMPANY  
Industrial Components Operation  
Quincy, MA 02169



April 1980

Final Report for Period August 1976 - August 1979

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MANUFACTURING METHODS AND TECHNOLOGY  
ENGINEERING (MM&TE) PROGRAM FOR THE  
ESTABLISHMENT OF PRODUCTION TECHNIQUES  
FOR HIGH DENSITY THICK FILM CIRCUITS USED  
IN CRYSTAL OSCILLATORS

FINAL REPORT - VOLUME II

APRIL 1980

CONTRACT No. DAAB07-76-8119

Prepared by

R. MICHEL ZILBERSTEIN

ACKNOWLEDGEMENT STATEMENT

This project has been accomplished as part of the U S Army Manufacturing and Technology Program which has as its objective the timely establishment of manufacturing processes, techniques, or equipment to ensure the efficient production of current or future defense programs.

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**OPERATION STANDARDS (Continued)**

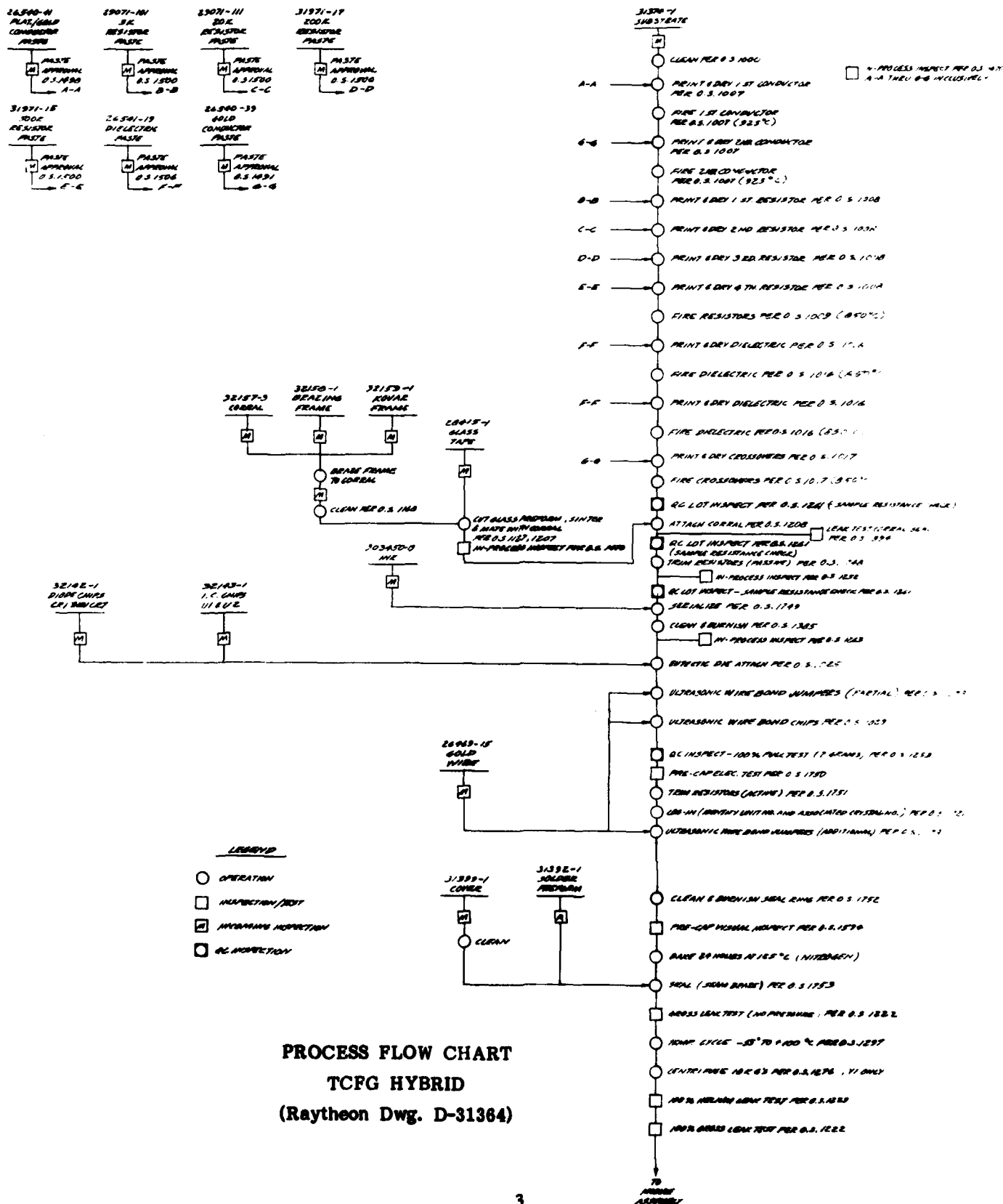
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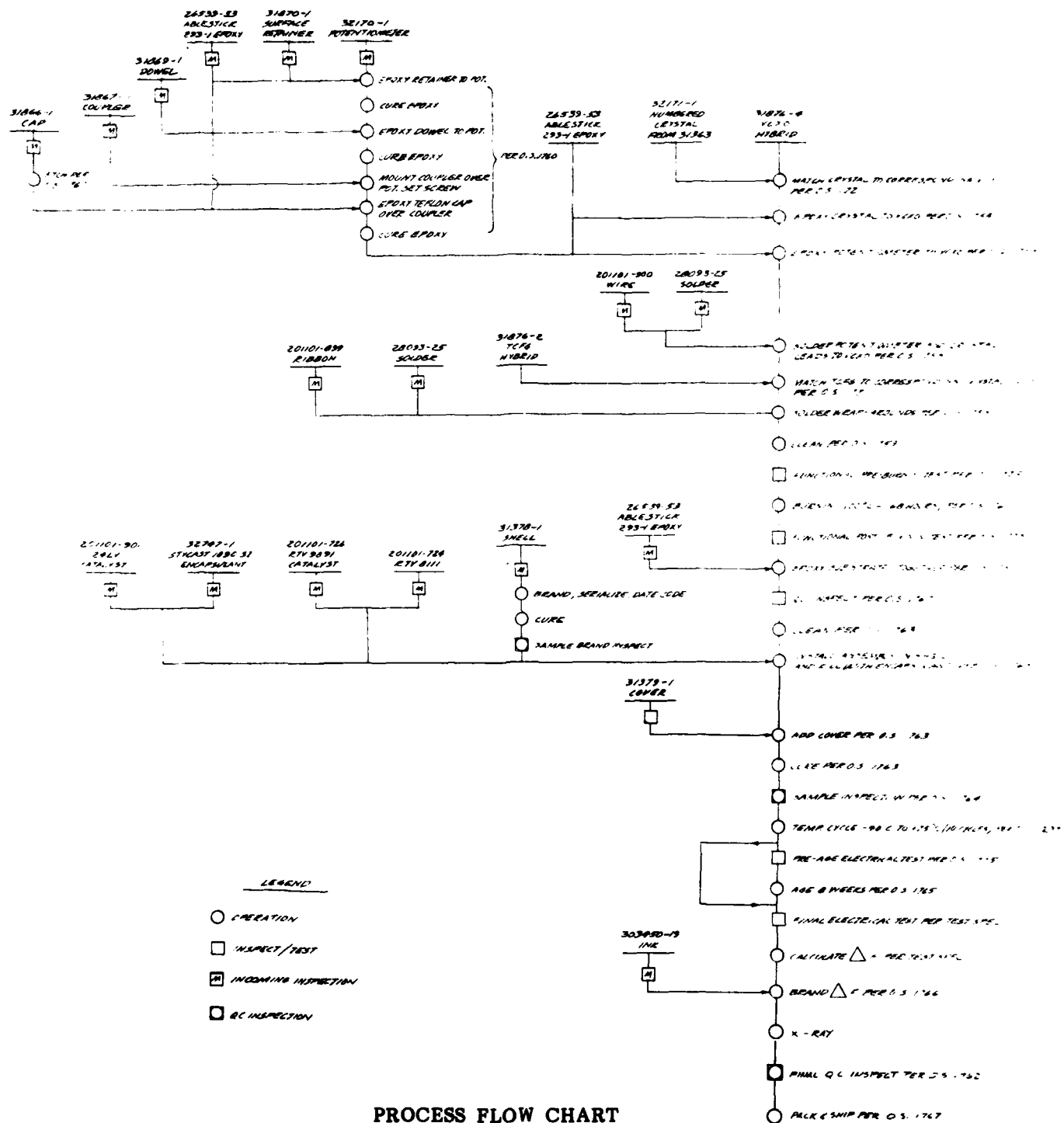
## **PART II**

### **INTRODUCTION**

Part II of the Final Report on the "Manufacturing Methods and Technology Engineering (MM&TE) Program for the Establishment of Production Techniques for High-Density Thick-Film Circuits Used in Crystal Oscillators" includes manufacturing flow charts, and detailed descriptions of all manufacturing, testing, and quality control procedures employed in the production of the TCVCXO, ERADCOM Specification SCS 483. While the device shares many of the standard procedures evolved at Raytheon-Quincy for all types of thick-film hybrids, a large proportion of the processes and techniques described in this section reflect the unique requirements of this application.











RAYTHEON COMPANY

Form 20-0044

Operation Standard		1000
Sheet	1	Rev. 2
Date		May 4, 1978
Subject		POC 78-6211

CLEANING NEW CERAMIC SUBSTRATES

1.0 EQUIPMENT:

- 1.1 Ultrasonic cleaner, frequency 25 KC.
- 1.2 3000 ml. glass beakers
- 1.3 Drying oven (125°-150°C)
- 1.4 Glass jar
- 1.5 Pyrex glass trays
- 1.6 Glass rod

2.0 MATERIALS:

- 2.1 Ceramic substrate
- 2.2 Trichloroethane (Degreaser Grade)
- 2.3 Acetone (Electronic grade)
- 2.4 Isopropanol (Electronic grade)

3.0 PROCEDURE:

- 3.1 Place ceramic substrates in a glass beaker to approximately 500 ml. mark.
- 3.2 Cover the substrates with trichloroethane to approximately 750 ml mark.
- 3.3 Clean in ultrasonic apparatus for 15 minutes. Using glass rod stir the substrates every 3-4 minutes.
- 3.4 Drain the trichloroethane and cover the substrates with Acetone.
- 3.5 Clean in ultrasonic apparatus for 5 minutes stirring occasionally.
- 3.6 If the acetone becomes cloudy, drain it and repeat as in 3.5.
- 3.7 Drain the Acetone and cover the substrate with Isopropanol.



RAYTHEON COMPANY

Form 20-0044

		Operation Standard	1000
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		Rev.	1
		Date	May 4, 1978
Subject	CLEANING NEW CERAMIC SUBSTRATES		POC 78-6211

3.0 PROCEDURE: Cont.

- 3.8 Clean in ultrasonic apparatus for 5 minutes stirring occasionally.
- 3.9 Transfer the substrates into the glass tray and air dry for 15 minutes. DO NOT HANDLE WITH BARE HANDS.
- 3.10 Place the tray with substrates in an oven at 125°-150°C for 2 hours.
- NOTE: Do not close the oven door completely for the first 5 minutes the substrates are in the oven.
- 3.11 After drying, cool down the substrates to room temperature and transfer them into clean glass jars. DO NOT HANDLE WITH BARE HANDS.
- 3.12 Mark the jar with the word "CLEANED, DATE, and TYPE of substrate," and "DO NOT HANDLE SUBSTRATES WITH BARE HANDS."



Page 22 of 44

Operation Standard		1007
Sheet	1	Rev. 10
Date May 4, 1978		
POC 78-6211		

**1.0 PURPOSE:**

This specification outlines the requirements to be met in printing conductor patterns on to ceramic substrates.

## 2.0 SAFETY:

Avoid contact and inhalation of solvent and vapors from conductor paste. The use of gloves when cleaning with Axothane VG is recommended. Otherwise standard safety precautions should be observed.

### 3.0 APPLICABLE DOCUMENTS:

### 3.1 Operation Standards

- 3.1.1 Procedure for Adjusting Resistor and Conductor Paste Viscosity O.S. 1048
- 3.1.2 Screener Set-Up O.S. 1011
- 3.1.3 Firing Schedules - Furnace Profiles O.S. 1012
- 3.1.4 Adhesion Test O.S. 1022
- 3.1.5 Conductor Paste Approval O.S. 1491  
O.S. 1498  
O.S. 1501
- 3.1.6 Conductor Paste Control and Identification Procedure O.S. 1051

#### 4.0 EQUIPMENT, TOOLING, GAUGES:

#### 4.1 Equipment

- 4.1.1 Presco Screener
- 4.1.2 Screens
- 4.1.3 Conveyorized Drying Oven
- 4.1.4 Firing Furnace
- 4.1.5 Microscope 7.5 -30X magnification
- 4.1.6 Clevite Brush Surfanalyzer Model 150
- 4.1.7 Viscometer
- 4.1.8 Heller Mixer

## 4.2 Tooling

- #### 4.2.1 Small tooling, gloves, finger cots, stainless steel tweezers

[illegible]



RAYTHEON COMPANY

Operation Standard	1007
Sheet 2	Rev. 8
Date	May 4, 1978
Subject	CONDUCTOR SCREENING
	POC 78-6211

4.0 Cont.

4.3 Gages:

4.3.1 Nikon Comparator and charts

5.0 PROCESS REQUIREMENTS:

## 5.1 Material Requirements:

5.1.1 Conductor pastes shall have viscosity adjusted to the ranges specified in Table I.

TABLE I

<u>MATERIAL</u>	<u>PART NUMBER</u>	<u>VISCOSITY (RVU)</u>	<u>THINNER</u>
C6010	28205-3	23.65-26.0	VS 372
RQ.	28205-37	23.65-26.0	VS 372
9885	26540-41	24.0-26.0	9180
9791	26540-39	25.0-26.0	9972
8151	26540-1	30.0-35.0	8250
9260	26540-37	25.0-26.0	8250

Reference should be made to O.S. 1048 - "Procedure for Adjusting Resistor and Conductor Paste Viscosity".

## 5.2 Environment:

5.2.1 Room temperature shall be 72°±3°F.

5.2.2 Room relative humidity shall be 38% minimum to 62% maximum

## 5.3 Screening Operation:

5.3.1 Set up Presco screener. Reference should be to O.S. 1011.

5.3.2 Screener shall be set up to obtain fired heights as specified in Table II. Heights to be measured with Clevite Brush Surf-analyzer.



RAYTHEON COMPANY

Operation Standard	1007
Sheet 3	Rev. 8
Date May 4, 1978	
POC 78-6211	

Form 20-1044

Subject	CONDUCTOR SCREENING
---------	---------------------

5.0 PROCESS REQUIREMENTS: CONT.TABLE II

<u>MATERIAL</u>	<u>FIRED HEIGHT RANGE</u>	<u>DRIED HEIGHT</u>
C6010	0.6 - 1.2 mils	1.2 - 2.0 mils
RQ1	0.6 - 1.2 mils	1.2 - 2.0 mils
9885	0.5 - 0.7 mils	1.0 - 1.4 mils
9791	0.4 - 0.7 mils	0.9 - 1.4 mils
8151	0.5 - 0.8 mils	1.0 - 1.6 mils
9260	0.4 - 0.6 mils	0.9 - 1.2 mils

5.3.3 After printing, allow prints to level 5-10 minutes prior to drying.

5.3.4 Dry in conveyORIZED oven at 120°C +5°C for 20 minutes.

5.3.5 Handling Notes:

1. Finger cots shall be worn at all times when handling substrates.
2. Tweezers shall be used when placing substrates on firing belt and when removing substrates from firing belt.
3. Axothane VG shall be used for cleaning screens.

\*NOTE: When cleaning of screen is necessary during a screening run, at least two dummy substrates must be screened prior to re-suming the screening of production pieces.

5.4 Firing Procedures:

5.4.1 Conductor materials are to be fired per O.S. 1012

5.4.2 All handling of substrates during loading and unloading for firing is to be done with tweezers.



RAYTHEON COMPANY

Form 10-10044

		Operation Standard 1007	
		Sheet 4	Rev. 8
		Date May 4, 1978	
Subject CONDUCTOR SCREENING		POC 78-6211	

6.0 PROCESS CONTROL:

- 6.1 Control points as in Table III
- 6.2 Workmanship criteria as specified in O.S. 1265 shall apply to conductors screened onto substrates.

**RAYTHEON**

**RAYTHEON COMPANY**

INDUSTRIAL COMPONENTS DIVISION

Thick Film

Form 20-0044

Operation Standard 1007	
Sheet 5	Rev. 2
Date May 4, 1978	
POC 78-6211	

Subject

ELECTRODE SCREENING

TABLE III  
Electrode Screening Process Control  
After Drying

DEFECT CRITERIA	AOQL	GAGES	MPC	ACTION
Bridges Conductors - none allowed				
Conductor Voids $> .003"$ in width of land or 25% whichever is greater		10 X microscope mounted to enable inspection without removal of parts from machine	E = 5 min sample to be inspected on screener stage M = 2 consecutive parts C = 0	Stop production adjust machine to correct defects. 100% inspect parts made since previous check.
Paste in Holes $> 20\%$ of hole dia	2%			
Smearing - min. space between lands $.005"$ . Spacing to edge of substrate $.003$ :				
Registration $> \pm .010"$ established reference	6%	Microscope with Reticle	E = 1 hour n = 4 consecutive parts C = 0	Stop production correct and 100% inspect since previous check.
Conductor Height - SEE TABLE II	6%	Surfanalyzer	F = 1 hour n = 4 sequential parts C = 0	stop and correct
Room Environment - $72^{\circ} \pm 3^{\circ} F$ $50 \pm 12\% R.H.$	NA	Temp/RH Recorder	F = 1 hour (by PC girl)	



Operation Standard		1008
Sheet	1	Rev. 8
Date	May 8, 1979	
POC 79-6390 JMK 5/8/79		

## SCREENING RESISTORS

POC 79-6390

2mk 5/8/79

151

This operation standard outlines the procedures to be followed for screening and firing of resistor pastes.

Contact and inhalation of solvent and vapors is to be avoided. Use of gloves when cleaning with Axothane VG is recommended. Otherwise standard safety precautions should be observed.

### 3.0 APPLICABLE DOCUMENTS:

- 3.1 Resistor Paste Approval O.S. 1500
- 3.2 Resistor Paste Blending Procedure O.S. 1036
- 3.3 Screener Set-Up O.S. 1011
- 3.4 Firing Profile, Characteristics, Use, and Frequencies O.S. 1012

#### 4.0 EQUIPMENT, TOOLING, GAUGES:

- 4.1 Presco Screener
- 4.2 Screens
- 4.3 Microscope 7.5 - 30X magnification
- 4.4 Conveyorized Drying Oven
- 4.5 Firing Furnaces
- 4.6 Clevite Brush Surfanalyzer Model 150
- 4.7 Small tooling, gloves, finger cots, stainless steel tweezers

## 5.0 ENVIRONMENT:

- 5.1 Room environment shall be maintained in accordance with O.S. 1507.

[illegible]





RAYTHEON COMPANY

Form 20-1044

		Operation Standard 1008	
		Sheet 2	Rev. 7
		Date June 27, 1978	
Subject	SCREENING RESISTORS		POC 78-6365

6.0 PRODUCT REQUIREMENTS:

6.1 Resistor heights shall be within the limits of Table I.

TABLE I

<u>RESISTOR TYPE</u>	<u>DRIED HEIGHT</u>	<u>FIRED HEIGHT</u>
EMCA Firon	1.0 - 2.4 mils	0.6 - 1.2 mils
DuPont Birox	0.9 - 1.1 mils optimum 0.9 - 1.3 mils maximum	0.40 - 0.60 mils optimum 0.40 - 0.70 mils maximum

6.2 Screened resistors shall meet all workmanship criteria established by O.S. 1265.

7.0 PROCESS REQUIREMENTS:

7.1 Set up screening machine per O.S. 1011.

7.2 Follow the Flow Chart I to determine the correct set-up and resistor pastes to be used. The following guidelines should be used in screening of resistor pastes.

7.2.1 After proper registration and best set-up are achieved, a minimum of (ten(10) squeegee wipes should be made to "Break In" the screen, ink etc., before screening the samples.

7.2.2 When the screen is cleaned with Xothene, it is important that a minimum of (2) substrates be screened prior to screening any samples or production substrates.

7.2.3 Allow screened resistors to level at room temperature for 5-10 minutes prior to drying.

7.2.4 Resistors shall be dried in conveyor oven at  $120^{\circ}\pm 5^{\circ}$  for twenty (20) minutes.

7.2.5 When firing resistor samples, simulate loaded kiln conditions by placing 12" of ceramic substrates in front of and in back of samples.

7.2.6 No other materials (Dielectrics, Conductors etc.) are to be fired in resistor furnace during resistor firing.



RAYTHEON COMPANY

		Operation Standard 1008	
		Sheet 3	Rev. 2
		Date May 8, 1979	
Subject SCREENING RESISTORS		POC 79-6390	

7.0 PROCESS REQUIREMENTS: Cont.

7.2.7 Tweezer handling of substrates is mandatory for loading and off loading substrates from furnace. No substrate stacking is permitted. Handling without finger cots is forbidden at any time.

7.2.8 Sequence of screening resistors is optional if all resistors are co-fired.

8.0 PROCESS CONTROL:

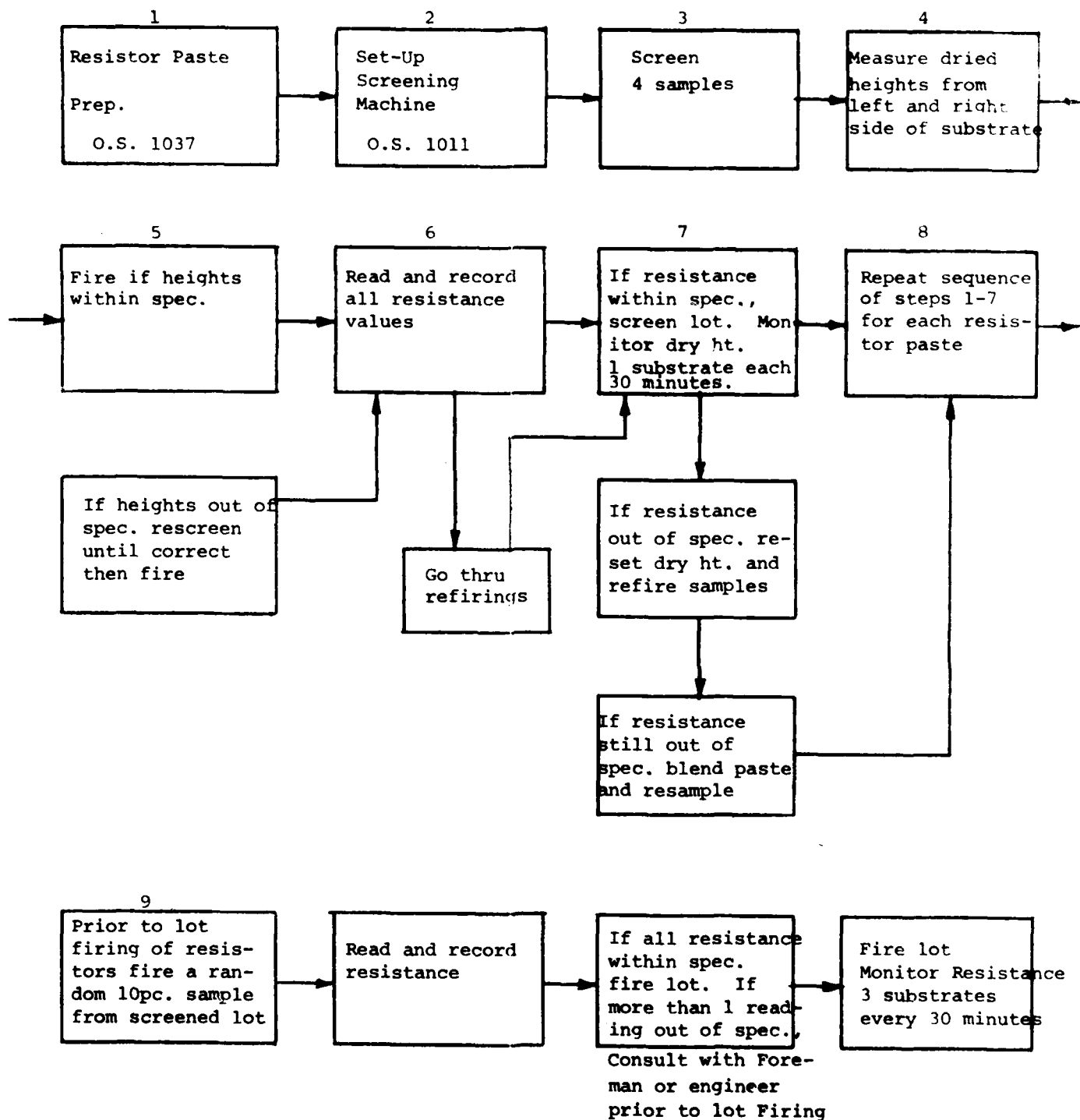
8.1 Screen operators monitor pattern fidelity (Registration, Voids, etc.) by checking at least (1) one substrate for every twenty-five (25) screened.

8.2 Monitor dried heights by taking one (1) substrate every 30 minutes from the drying belt. Record dry heights. Heights must be within the same limits established by the resistor paste tests.

8.3 Prior to any lot firing of resistors, a random sample from the screened lot is to be fired. Resistors are to be read and recorded to determine that resistors are still within specified ranges. A minimum of five (5) sample substrates are to be so fired.

9.0 DOCUMENTATION:

Production inspection records shall be maintained for one year unless program requirements dictate otherwise.



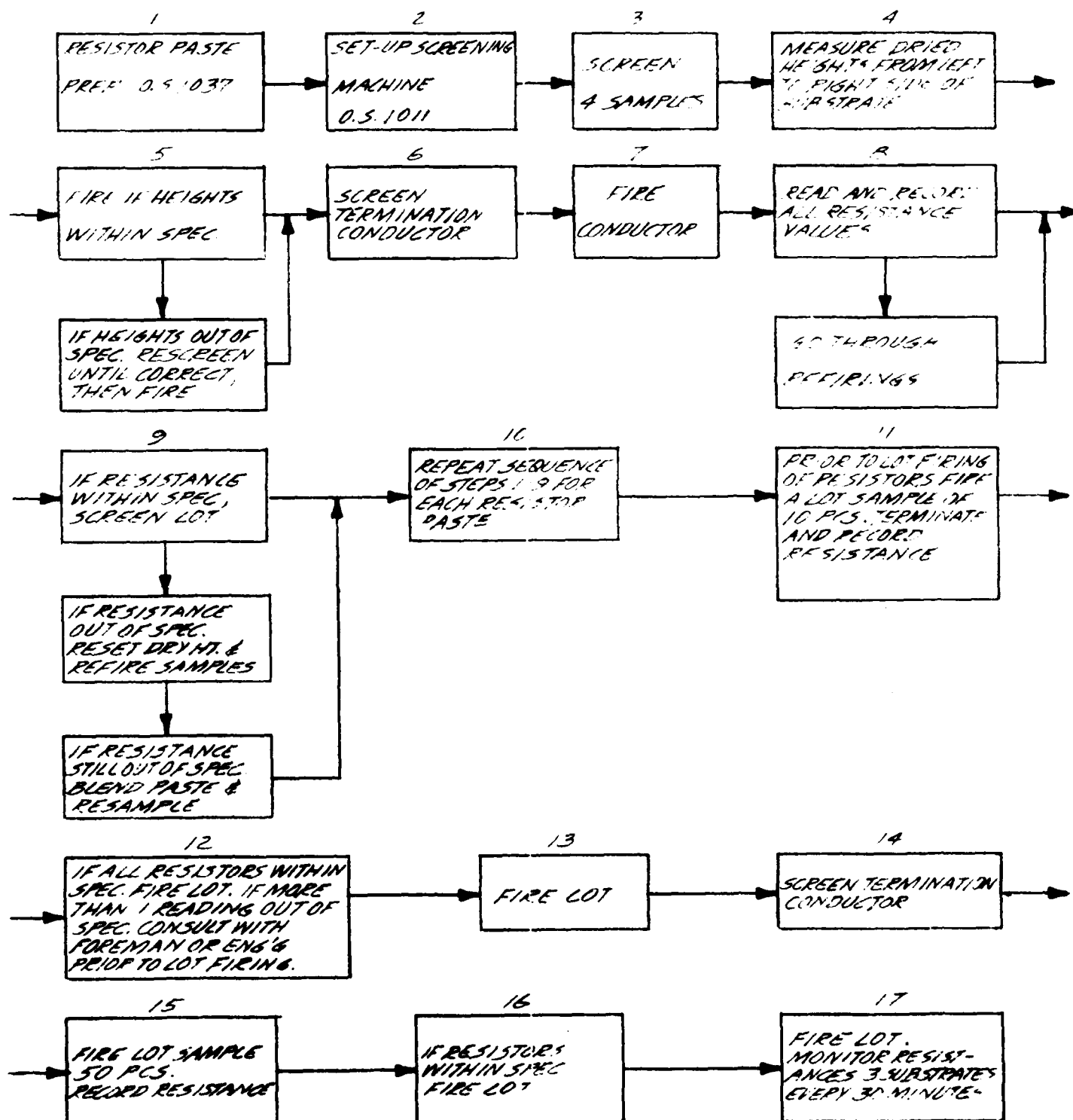
FLOW CHART I

RESISTOR SAMPLING PROCEDURE

# FLOW CHART II

O.S. 1008 Rev. 0  
 Sheet 5 of 5  
 June 27, 1978  
 POC 78-6365

## Resistor Sampling Procedure For Post Terminated Resistors:



## NOTES ON PROCESSING OF POST TERMINATED RESISTORS:

- (1) Procedures for lot processing shall be identical to procedures used for sampling of resistors.
- (2) The identical lot number of conductors shall be used for sampling and lot screening.



Operation Standard		1016 S
Sheet	1 of 2	Rev. 0
Date November 27, 1968		
POC 68-9431		

## 1.0 PURPOSE:

To specify a procedure for screening crossover glaze and to specify firing conditions.

## 2.0 SAFETY:

- 2.1 Avoid excessive contact and inhalation of solvent fumes.
- 2.2 Use caution near moving parts of the screener.

### 3.0 APPLICABLE DOCUMENTS:

- 3.1 Screener Setup Procedure - O.S.1011  
3.2 Profiling Procedure - O.S.1013

#### 4.0 EQUIPMENT, TOOLING AND GAUGES:

- 4.1 Air firing Furnace - Thick Film  
4.2 Screener - Presco  
4.3 Crossover Glaze - Dupont 8190 or equivalent

## 5.0 PRODUCT REQUIREMENT :

- 5.1 Crossover area must be free of holes as seen under 7X magnification.
- 5.2 Crossover area must not exceed the specified dimension in the print by more than .010" max. and must be no smaller in area than indicated on the print.
- 5.3 The crossover must have a smooth, even appearance free of pits and bumps as seen under 7X magnification.

## 6.0 PROCESS REQUIREMENTS:

- 6.1 Tweezer handling of substrates is required and finger cots shall be used.
- 6.2 Room Temperature to be  $72^{\circ}\text{F} \pm 3^{\circ}\text{F}$ .
- 6.3 Crossover is to be dried between  $100^{\circ}\text{C} - 125^{\circ}$  for 10-15 minutes of each application.

[illegible]



RAYTHEON COMPANY

INDUSTRIAL COMPONENTS DIVISION

Form 20-0044

Operation Standard	1016
Sheet 2 of 2	Rev. 0
Date	November 27, 1968
Subject	CROSSOVER SCREENING AND FIRING SCHEDULE
	POC 68-9431

6.0 PROCESS REQUIREMENTS: (Continued)

6.4 Two coatings of crossover glaze are required as follows:

6.4.1 Screen the 1st layer

6.4.2 Dry

6.4.3 Fire as in 6.5

6.4.4 Screen the 2nd layer

6.4.5 Dry

6.4.6 Fire as in 6.5

6.5 Fire crossover glaze as follows:

6.5.1 Peak belt temperature of  $870^{\circ}\text{C} \pm 10^{\circ}\text{C}$

6.5.2 (4-6) minutes soak at peak temperature.

7.0 PROCESS CONTROL:

7.1 Once an hour examine 10 pieces as per P5 Product Requirement.

8.0 QUALITY:

8.1 Process audit as per requirements in P5.



Operation Standard 1017 S	
Sheet 1 of 2	Rev. 0
Date November 27, 1968	
POC 68-9427	

## 1.0 PURPOSE:

To specify a procedure for screening and firing second conductor over crossover glaze.

## 2.0 SAFETY:

- 2.1 Avoid excessive contact and inhalation of solvent fumes.
- 2.2 Use caution near moving parts of the screener.

### 3.0 APPLICABLE DOCUMENTS:

- 3.1 Screener Setup Procedure - O.S.1011
- 3.2 Profiling Procedure - O.S.1013
- 3.3 Crossover screening and firing schedule - O.S.1016

#### 4.0 EQUIPMENT, TOOLING & GAUGES:

- 4.1 Air firing furnace - Thick Film  
4.2 Screener - Presco  
4.3 Ohmmeter - Digital or equivalent  
4.4 Conductor Paste - 7553 Dupont or C6010 Alloys Unlimited.

## 5.0 PRODUCT REQUIREMENTS:

- 5.1 Second conductor must be continuous and must contact and overlap it's termination by .005" minimum.
- 5.2 The conductor width must be no less than  $\frac{2}{3}$  the specified width nor wider than .010" over the specified width.
- 5.3 The size of holes or indents must be such as not to reduce the width by more than  $\frac{1}{3}$ .
- 5.4 The conductor should not appear to be sunk into the crossover glaze in excess of requirements as in 5.2.

[illegible]



RAYTHEON COMPANY  
INDUSTRIAL COMPONENTS DIVISION

Form 20-0044

Operation Standard	1017
Sheet 2 of 2	Rev. 0
Date	November 27, 1968
Subject	POC 68-9427

Subject SECOND CONDUCTOR SCREENING AND FIRING  
SCHEDULE

5.0 PRODUCT REQUIREMENTS: (Continued)

5.5 There shall be no shorting between the second conductor and the conductor underneath as measured with a digital or other suitable ohmmeter.

6.0 PROCESS REQUIREMENTS:

- 6.1 Tweezer handling of substrates is required and finger cots shall be used.
- 6.2 Room temperature to be  $72^{\circ}\text{F} \pm 3^{\circ}\text{F}$ .
- 6.3 Screen the second conductor to meet the requirements of P5.
- 6.4 Dry at  $100^{\circ}\text{C} - 125^{\circ}\text{C} - 10-15$  minutes.
- 6.5 Fire in the  $760^{\circ}\text{C}$  resistor firing furnace at a speed of 3"-5"/min.

7.0 PROCESS CONTROL:

- 7.1 Once an hour examine and short check after timing to meet P5.
- 7.2 Once an hour perform a visual examination to meet requirements of P5.1-P5.4 at screening before firing.

8.0 QUALITY:

- 8.1 Process audit as per requirements of P5.





Form 20-0044

RAYTHEON COMPANY

Operation Standard		1025
Sheet 1	Rev. 11	
Date July 14, 1978		
POC 78-6282 78-6410		

1.0 PURPOSE:

To bond the die to the substrate or header by forming a gold silicon eutectic.

## 2.0 SAFETY:

Use normal safety precautions in working near hot work fixtures.

### 3.0 EQUIPMENT AND TOOLING:

- 3.1 Die Attach Bonder: (K/S Model 607 or equivalent.)
- 3.2 Tweezers 3-C or equivalent
- 3.3 Heat Column Top Plate:
  - 3.3.1 K & S - 601-14-0 (For TO-5 header) or equivalent
  - 3.3.2 K & S - 601-117-0 (For 1" X 1" substrate or equivalent
  - 3.3.3 K & S - 601-101-0 (For 1/2" X 1/2") or equivalent
- 3.4 Heat Collets: No. 5800 Titanium Carbide or equivalent
- 3.5 **Mini heater No. 302** or equivalent
- 3.6 Nitrogen Atmosphere Storage Cabinet
- 3.7 Hot Plate - Thermolyne Model No. HPA1915B or equivalent
- 3.8 Mirrors No. 607-1-6 or equivalent
- 3.9 Mirror holder NO. 607-5V (with tray) or equivalent
- 3.10 Heater collet transforms No. 5037 or equivalent
- 3.11 Perforated (1" X 1/4 diamond holes) 1/32" thick aluminum plate 5 x 5 x 3/8 high.

#### 4.0 MATERIAL AND SUPPLIES:

- 4.1 Hybrid Circuits
- 4.2 Chips on mirrors to be bonded.

[illegible]



## RAYTHEON COMPANY

		Operation Standard 1025	
		Sheet 2	Rev. 10
		Date August 7, 1978	
Subject	DIE ATTACH	POC 78-6282 6410	

5.0 PRODUCT REQUIREMENT:

5.1 O.S. 1265

6.0 PROCESS PROCEDURE:

- 6.1 All devices are to be die attached as follows, unless listed below. Heat column limits of 355°C - 365°C and specification limits will be 350°C - 370°C with a flow of nitrogen over unit to be bonded at the heat column surface. "For APP H60243 - LSI attach control limits to be 380°C - 390°C and specification limits 375°C - 395°C."
- 6.2 Place the proper size die collet to be used in the machine and turn on Variac to approximately 9.0. Make sure that the collet is being heated by just touching the side of the heater on the die collet.
- 6.3 After each collet change wait approximately 1-2 minutes for collet to reach the temperature of 400°C-500°C for control limit and specification limit at 400°C-550°C before starting die attach.  
NOTE: Vacuum must be in OFF position.
- 6.4 Place the units to be die attached on a hot plate. A maximum of ten units may be on the hot plate. Temperature for hot plate "Control Limits" 190°-210° and Specification Limits 190° - 250°. For APP H60243 - Place a maximum of 5 (five) units on the preheat perforated plate sitting on the hot plate. Allow to heat there for a minimum of 3 (three) minutes. Remove 1 (one) unit and place on hot plate for a minimum of 3 (three) minutes before transferring to heat columns.
- 6.5 Working from the hot plate place the unit on the heat column and place under vacuum to hold the unit down. Pick up the semiconductor chip to be attached making sure it fits square in the die collet and the chip is in the right position per the Assembly Dwg. for the circuit being die attached.
- 6.6 Attach chip to substrate making sure you have good gold eutectic flow around chip by controlling the Mech. Vibrator of the die collet and no eutectic balls around the chip.



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#### 6.0 PROCESS PROCEDURE: Cont.

- 6.7 Raise collet and remove the unit from the heat column. Place the unit upside down on the carrying tray resting on the corral. For APP H60243 - Place the unit on the hot plate corral side up for a minimum of 3 (three) minutes then place it on the perforated plate corral side up for a minimum of 3 (three) minutes and then place at angle on edge of an aluminum tray or flat on an aluminum foil covered fiber tray.

NOTE: For small substrates the hot plate can be eliminated.

#### 7.0 REWORK:

- 7.1 Element Replacement for Hybrid and Multichip Microcircuits. Unless otherwise specified, replacement of attached elements in hybrid and multichip microcircuits shall be permitted with the following limitations:
- 7.2 Replacement of active or passive attached elements shall be limited to a maximum of 2 devices or 15 percent of the total number of such elements in the microcircuit, whichever is greater.
- 7.3 Regardless of the number of allowable element replacements, all replacement of elements of the microcircuit must be accomplished in no more than two recycles of any single microcircuit for rework.

#### 8.0 INSPECTION:

- 8.1 See O.S. 1263

#### 9.0 MAINTENANCE:

- 9.1 K & S #607-5, See Section 4 and also Section 2, "Adjustment"
- 9.2 Calibrate heat, column temperature each day.
- 9.3 Attach a thermocouple to a substrate in location where a die would normally go.
- 9.4 Place substrate thermocouple assembly in place on heat column and read millivolt output on galvanometer. Use chart to convert to degrees.
- 9.5 Correct temperature by raising or lowering heat control.



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Form 20-0044

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Subject NOTES ON #607-5 DIE BONDER		POC 72-6213	

1. Heat column height must be set so that bonding area of substrate or header is same as die pick-up mirror tray. This adjustment can only be made when heat column has reached full temperature.
2. Adjust microswitch, tripped by Z lever, so that vacuum makes as collet reaches die pick-up tray and breaks as collet reaches bonding surface.
3. Die collet should be square to bonding surface so there will be no sliding action during bonding sequence. Adjustments can be made at several points in the linkages and checking is done by observing the collet imprint on a scrap header or substrate.
4. Substrates, headers, preforms and dice must not be handled with bare fingers. Finger cots must be worn. Handle parts carefully with tweezers where practicable. For K & S #607-5 see Start-Up, paragraph of Section 3, "System Operation" in the Instruction Manual. (For most jobs substitute "substrate for header").
5. Operation
  - 6.1 K & S #607-5, see Section 3 of Instruction Manual.
6. SHUTDOWN:
  - 6.1 K & S #607-5, see Section III of Instruction Manual.

August 3, 1978

## VENDOR

OPERATION		FAIRCHILD	MOTOROLA	SILICON GEN.	NATIONAL	SOLITRON	TI
MAGNOVOX  ONLY	u1 to Moly Tab	370°C Preform 26367-17	365°C No Pre- form				
	Moly Tab to Substrate	375°C Preform 26367-15	365°C No Pre- form	400°C Preform 26367-27			
	CR1 to Moly Tab						370°C No Pre- form
PATRIOT  ONLY	u2 to Moly Tab	375°C Preform 26367-17	365°C No Pre- form	400°C Preform 26367-27			
	Moly Tab to Substrate	390°C Preform 26367-15	390°C Preform 26367-15	390°C Preform 26367-15			
	CR1 & CR2					400°C No Preform	
RAYSCAT  ONLY	u2 to Be <sup>o</sup> Tab			400°C Preform 26367-27	400°C Preform 26367-27		
	Be <sup>o</sup> Tab to Substrate			390°C Preform 26367-15	390°C Preform 26367-15		
	CR1, CR2, CR3					400°C No Preform	

NOTE: All Above Temps.  $\pm 5^{\circ}\text{C}$ 

For Ecom Only:

VCX0 CR11 & CR12 to be bonded with heat column at  $390^{\circ}\text{C} \pm 5^{\circ}$ , TCFG Heat column to be set at  $365^{\circ}\text{C} \pm 5$ .

For FTD Only:

Interface CR1 & CR5 w/preform set heat column at  $415^{\circ}\text{C} \pm 5$ , CR7 & CR8 set heat column at  $415^{\circ}\text{C} \pm 5$ , all others set heat column at  $380^{\circ}\text{C} \pm 5$ .

For H60385 Only:

Set upper control limit at  $410^{\circ}\text{C}$  maximum. Upper specification limits  $430^{\circ}\text{C}$  maximum.

NOTE: Always die attach devices that require the highest temperature first.



RAYTHEON COMPANY

Subject  ULTRASONIC BONDING - GOLD	Operation Standard 1029	
	Sheet 1	Rev. 3
	Date May 26, 1977	
		POC 77-6187

5.1

## 1.0 PURPOSE:

To attach very fine gold wires between active contact areas of semiconductor chips and thick film conductor pads or package leads, or between two conductor pads by Ultrasonic Bonding Techniques.

## 2.0 SAFETY:

Normal safety precautions for work near heat columns, gas flames, and high voltage electrodes.

## 3.0 APPLICABLE DOCUMENTS:

- 3.1 Instruction Manual for K+S, model 479 and Mech EL model Nu837, Ultrasonic Wire Bonder.
- 3.2 Instruction manual for K+S 4320A and Uti Model 5C Ultrasonic Generator

## 4.0 TOOLS AND EQUIPMENT:


- 4.1 Bonding Capillary, Microswiss #472A or equivalent
- 4.2 Brook flow gauge 0-225 SCFH, model H2 or equivalent.
- 4.3 Wrist ground straps - for use with MOS devices
- 4.4 Tweezer, Hub #7 or equivalent
- 4.5 Tweezer, Hub #AA or equivalent
- 4.6 Metal trays
- 4.7 Kulicke and Soffa model 2479, wire bonder, Mechel Nu827 wire bonder

## 5.0 ENVIRONMENT AND MATERIAL:

- 5.1 Gold wire shall be maintained in dust free enclosures (standard industry shipping containers are sufficient) until loaded into wire feed assemblies.
- 5.2 The following gasses shall be supplied at the conditions indicated:

GAS	PRESSURE (PSI)	cu.ft. demand/hour/machine
Hydrogen	10-15	0.1
Oxygen	5-10	0.05

	1	2	3	4	5	6	7	8	9	10	11								
	0	0	0	0	0	0	0	0	0	0	0								

	RAYTHEON COMPANY	
	Operation Standard 1029	
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ULTRASONIC BONDING - GOLD		

5.3 Vacuum will be supplied to each machine at 15 inches.

5.4 Electrical power of 200 watts at 110-115 volts, 50 to 60 cycles is required per machine.

#### 6.0 PRODUCT REQUIREMENTS:

See O.S. 1253

#### 7.0 PROCESS PROCEDURE:

7.1 Set heat column temperature at  $150^{\circ}\text{C} \pm 10^{\circ}\text{C}$ , control limit is  $150^{\circ}\text{C} \pm 25^{\circ}\text{C}$  and specification limit is  $150^{\circ} + 50^{\circ}\text{C} - 25^{\circ}\text{C}$ .

7.2 Adjust capillary force to between 30 and 40 grams for the 1st bond and between 70 and 80 grams for the 2nd bond for 1 mill wire.

7.3 Set bond time and power as specified in notes for K+S 2479 and Mech EL, Nu 827 wire bonders

7.4 Hydrogen and Oxygen flow gauges shall be adjusted to maintain correct ball size. For 1 mill wire this settling will be around .10, for Mech EL and .05 for K+S. This will vary from machine to machine.

7.5 Pick up the unit to be bonded with tweezer and place on the heat column.

NOTE: Static ground strap must be worn, when bonding MOS devices.

7.6 Using the correct assembly drawing, ball bond to the semiconductor device and wedge bond to the substrate land area or package lead. Complete all wiring shown on the drawing.

7.7 Remove unit from the heat column and place on a metal tray to cool. Repeat the above steps for additional units to be bonded.

#### 8.0 PROCESS CONTROL:

See O.S. 1253

#### 9.0 QUALITY CONTROL:

See O.S. 1253 and O.S. 1265.



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Subject	Operation Standard 1029	
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	POC 77-6187	
NOTES ON MECH EL NU827 WIRE BONDER		

## 1.0 Flame Off

- 1.1 Ball size - generally should be twice wire size.
- 1.2 Hydrogen flow generally set at .10 on flow meter, using a 5002-2 torch
- 1.3 Ball size is controlled by:
  - a) Hydrogen flow (flame size)
  - b) Torch speed
  - c) Position of torch to wire
  - d) tail length

## 2.0 Equipment Set Up and Adjustment

- 2.1 Heat column should be adjusted so that capillary is level with work. An imprint of the capillary with a ball should give a perfect circle on a gold conductor.
- 2.2 Bond pressure for .001 wire should be 1st bond 30 to 40 grams, 2nd bond 70-80.
- 2.3 Capillary should be installed flush with top of transducer, using a new set screw.
- 2.4 Tune Uti generator to low point. Tune Mech-EL generator to high point.
- 2.5 Set time to 3.0 on Uti generator. Set time to 5.0 on Mech EL generator.
- 2.6 Turn up power on both ball and wedge until proper bond deformation is obtained. See figure 1

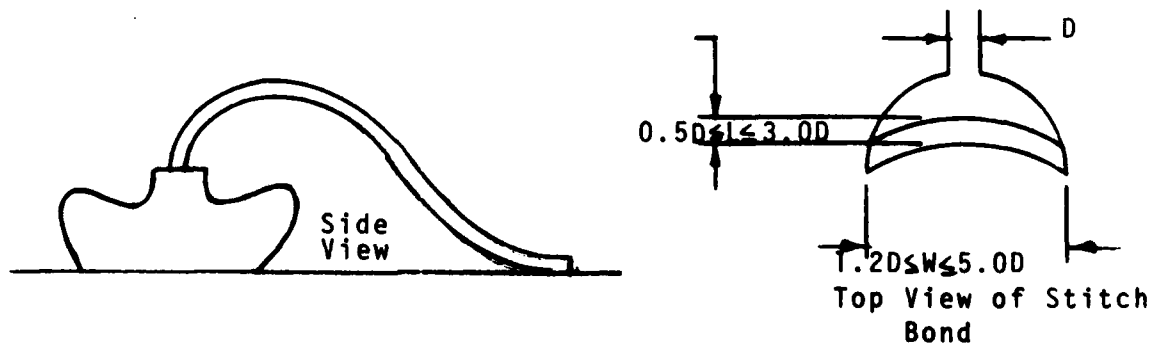



Figure 1



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Subject NOTES ON MECH EL NU827 WIRE BONDER			POC 77-6187	

### 3.0 Equipment Operation

#### 3.1 Start - up

- a) Turn on power; machine, Ultrasonic Generator, heat column heaters.
- b) Open hydrogen valve full (size of the .002" Orifice torch restricts flow to proper amount) light torch.
- c) Tune generator; Uti to a minimum, Mech-EL to a maximum.
- d) Cycle machine a few times to get machine in proper sequence.
- e) Practice bond on a piece of scrap to be sure machine is cycling properly.

#### 3.2 Operation

- a) Machine at reset - ball at end of wire
- b) Lower Z-arm until ball at the end of the capillary contacts semiconductor chip.
- c) Continue lowering Z-arm until ultrasonics fire and bond is made.
- d) Raise Z-arm until capillary lifts off semiconductor chip, machine cycles to second bond, L.E.D. lights.
- e) Loop wire, then lower Z-arm until capillary and wire contact second bond land surface.
- f) Continue lowering Z-arm until ultrasonics fire and bond is made. Clamps will close when bond is complete.
- g) Raise z-arm; capillary lifts off, tail forms, and wire breaks. Continue raising Z-arm until flame off activates and sweeps past the tail and forms a new ball, then clamps open.
- h) Machine now at reset, ready for next bond.


#### 3.3 Shut Down

- a) Be sure work is removed from work holder.
- b) Blow out Hydrogen torch.
- c) Turn off Hydrogen
- d) Turn off heaters, Ultrasonic Generator and machine power.

### 4.0 Trouble Shooting

#### 4.1 Won't bond

- a) Check temperature of work holder, (raise temp. if possible)
- b) Check work holder height
- c) Check for proper installation of capillary
- d) Check tune of generator

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Subject	NOTES ON MECH EL NU827 WIRE BONDER	
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- e) Check to see that generator fired when capillary contacts work.
- f) Check force on capillary
- g) Turn up Ultrasonic power until wire bonds.

#### 4.2 Inconsistent ball size

##### 4.2.1 Due to varying wire tail length.

- a) Check action of wire clamp after second bond.
  - 1. clamps close on wire
  - 2. clamps pivot downward
  - 3. raise Z-arm until torch flames across wire
  - 4. clamps open
  - 5. clamps pivot upward
- b) Check that clamps close right on wire.
- c) Check that clamp pivot bearing is tight.
- d) Check that clamp stop is tight.

##### 4.2.2 Flame Misadjusted

- a) Check that flame off torch and flame do not contact work
- b) Check that flame passes by the capillary.
- c) Check that torch is not binding on its bearing or is too loose.
- d) Check that Hydrogen hose is not jamming between flame off arm, and chassis.
- e) Check that torch position has not slipped up or down, in or out. The flame must contact the tail.
- f) Check that the flame is unrestricted, and cone shaped.

##### 4.2.3 Machine cycling properly

- a) Clamps remain closed while torch passes tail.
- b) Flame off operating only after second bond.



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NOTES ON MECK EL NU827 WIRE BONDER

- 4.3 Tailing (wire not breaking at second bond but half way up the wire)
- a) Check capillary for wear
  - b) Check temperature (lower if possible)
  - c) Check force
  - d) Turn time down and Ultrasonic power up
  - e) Replace capillary with a small inside cone capillary,,  
"Small Precision" part no. U+S-17S or equivalent.
- 4.4 Wire not breaking after second bond, lifting second bond.
- a) Check capillary for wear
  - b) Check temperature (raise if possible)
  - c) Check force
  - d) Lower force and raise Ultrasonic power
- 4.5 Ball size too small or large
- a) Check hydrogen flow
  - b) Turn tail adjust for proper size. Reduce tail length if ball size to large. Increase tail length if ball size to small.
- 5.0 Maintenance
- 5.1 Lubricate bearings and bushings on all moving parts monthly.
  - 5.2 Check all hoses for wear.
  - 5.3 Check all exposed wiring for wear.
  - 5.4 Check ground daily.



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Subject

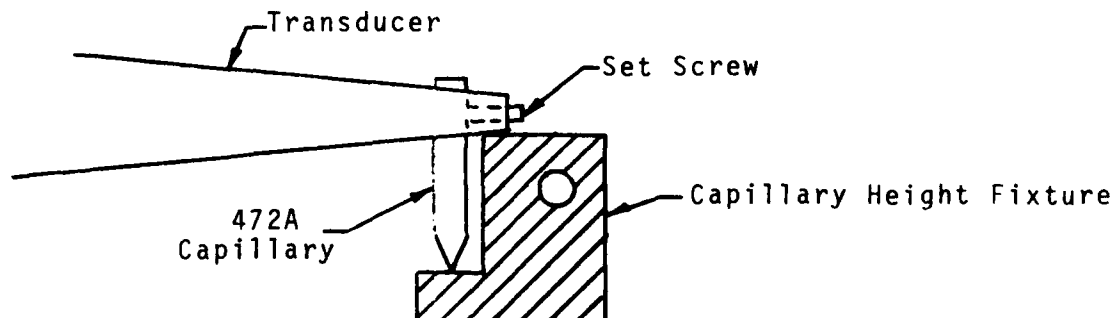
NOTES ON K+S 2479 WIRE BONDER

## 1.0 Flame off

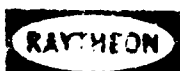
- 1.1 Ball size - generally should be twice wire size.
- 1.2 Hydrogen flow generally set at .05 on flow meter using a 5004-5 torch.
- 1.3 Oxygen flow generally set at .025 on flow meter using a 5004-3 torch.
- 1.4 Ball size is controlled by
  - a) Hydrogen oxygen flow (flame size)
  - b) Hydrogen oxygen flame mixture (flame sharpness)
  - c) Position of torch to wire
  - d) Tail length

## 2.0 Equipment set up and adjustment

- 2.1 Heat column should be adjusted so that capillary is level with work. An imprint of the capillary without a ball should give a perfect circle on a gold conductor.
- 2.2 Bond pressure for .001 wire should be 1st bond 30 to 40 grams, 2nd bond 70-80 grams.
- 2.3 Capillary should be installed using a K+S gauge block marked 472 as shown, using a new set screw



- 2.4 Push test button on generator for 5 seconds to tune generator, a deflection on the meter should be observed.
- 2.5 Install a new spool of wire. Start the wire from the red end of the spool. Feed the wire through the hole under the spool holder, between the glass slider, over the spring tensioner, through the guide ring, through the clamp guide, through the clamp, thread the capillary pushing the test switch if necessary.



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- 2.6 Open Hydrogen valve to .05, open Oxygen valve to .025.
- 2.7 Light flame with lighter
- 2.8 Cycle machine to flame off excess wire
- 2.9 Adjust Hydrogen and Oxygen flow until proper ball size is obtained.
- 2.10 Set time to between 1.0 and 2.0.
- 2.11 Turn up power on both ball and wedge until proper bond deformation is obtained. See Figure 1 in notes on Mech E1 Nu 827 Wire bonder.

### 3.0 Equipment operation

#### 3.1 Start - up

- a) Turn on power: machine, Ultrasonic generator and lights
- b) Open hydrogen flow valve to .05, open oxygen flow valve to .025. Light torch using lighter.
- c) Push test switch to tune generator.

#### 3.2 Operation in search mode

- a) Depress the Mode switch to the 479 position.
- b) Place a module in the work holder.
- c) Using the spot light target over the first chip pad to be bonded.
- d) Depress the chessman button to cycle the machine to first search position.
- e) Adjust the search height using the left hand lever.
- f) Correct any errors in targetting and release button. The ball will bond and the machine will cycle to loop position.
- g) Correct any miss-alignment in the spot light by turning the brass adjusting screws on the spot light assy.
- h) Using the spot light target over the correct land for second bond.
- i) Depress the chessman button to cycle the machine to second search.
- j) Adjust the search height using the right hand lever.
- k) Correct any error in targetting and release the button. The stitch will bond, the wire will break and the flame off torch will sweep across the raised capillary to form the ball for the next bond.

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NOTES ON K+S 2479 WIRE BONDER

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### 3.3 Operation in Hybrid mode

- a) Switch mode switch to the Hybrid position
- b) Place a module in the work holder
- c) Using the spotlight target over the first chip pad to be bonded.
- d) Depress the Z-arm, the clamps will open and the machine will cycle to the first bond mode.
- e) Continue to depress the Z-arm until the ball contacts the first chip bond pad. Continue depressing the Z-arm until the Ultrasonics fire and the ball is bonded to the chip.
- f) Raise the Z-arm to the top of the stroke to cycle the machine to the second bond mode. (Note: failure to release the Z-arm to the top of the stroke will result in the machine not cycling to the second bond mode and the machine will not bond coorectly during the following steps).
- g) Target over the correct land to be bonded
- h) Depress the Z-arm until the capillary and wire contact the land. Continue depressing the Z-arm until the Ultrasonics fire and the bond is made
- i) Raise the Z-arm to the top of the stroke. The clamps will close on the wire and pull up, breaking the wire off at the second bond. The flame off torch will sweep by the capillary, cut the wire and form the ball. The remaining tail will go down the vacuum tube. The machine is now in reset position.

### 4.0 Trouble Shooting

#### 4.1 Won't bond

- a) Check temperature of the work holder (raise temp. if possible)
- b) Check work holder height
- c) Check for proper instation of the capillary.
- d) Push test button, check for deflection of the needle on the tune meter.
- e) Check to see that the generator fires when the capillary contacts work. Adjust the micro switch if necessary.
- f) Check the force on the capillary, adjust if necessary.
- g) Check time setting between 1.0 and 2.0 for .001 wire.
- h) Turn up Ultrasonic power until the wire bonds.



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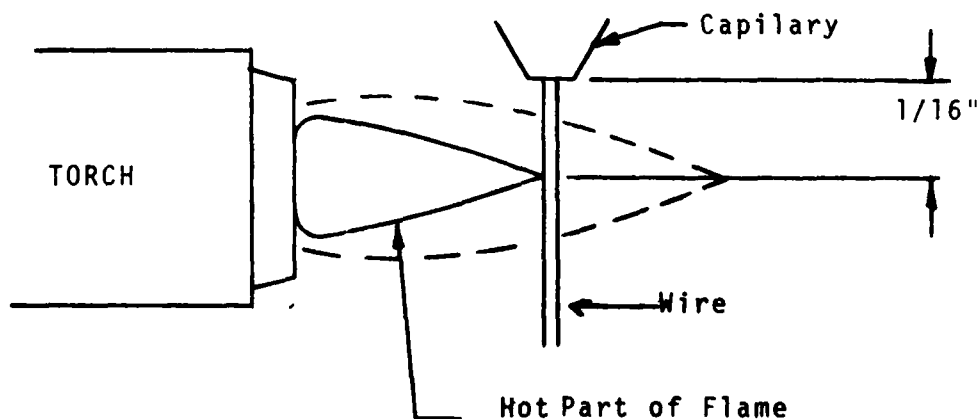
#### 4.2 Inconsistent ball size, search mode


##### 4.2.1 Due to varying wire tail length

- a) Check clamps closing tightly
- b) Check that clamp assy is tight
- c) Check that there is no foreign material in the clamp jaws.
- d) Check clamp actions:
  1. switch machine to set up mode
  2. manually turn the drive pulley and belt to cycle the machine
  3. reset position clamps closed
  4. as capillary goes down to the work, the clamp opens
  5. clamp stays open through; first bond, loop, second bond.
  6. clamp closes after second bond
  7. capillary moves up leaving a short tail
  8. clamp assy moves up breaking the wire
  9. torch flames off the tail forming the ball, machine is now back in reset position.

##### 4.2.2 Inconsistent ball size due to flame torch

- a) Check pressure at the oxygen and hydrogen tanks
- c) Check flow rate of oxygen and hydrogen
- d) Direct illuminator light away from work. Manually move flame to wire. Check shape of the flame and position of flame with respect to the wire and capillary. The tip of the hot part of the flame should be contacting the wire.



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Subject NOTES ON K+S 2479 WIRE BONDER	POC 77-6187	

- e) In the set up mode, manually cycle the machine to the flame off cycle. Check that the torch passes the wire by about 1/16 inch. Adjust linkage if necessary.
- f) After all position and linkage adjustments have been made, fine adjustment of the hydrogen and oxygen can be made to get correct ball size.  
 NOTE 1: If the flow rates are changed the position of the flame may change, creating the need for torch position to be readjusted.  
 NOTE 2: Increasing the hydrogen will make the ball larger, decreasing hydrogen will make the ball smaller. Increasing the oxygen will make the ball smaller, decreasing oxygen will make the ball larger.

4.3 Tailing (wire not breaking at second bond, but half way up the wire)

- a) Check capillary for wear
- b) Check temperature (lower if possible)
- c) Check force
- d) Turn time down and Ultrasonic power up
- e) Replace capillary with a small inside cone, capillary "Small Precision" part no. U+S-17S or equivalent.

4.4 Wire not breaking after second bond, lifting the second bond.

- a) Check capillary for wear
- b) Check temperature (raise if possible)
- c) Check force
- d) Lower force and raise Ultrasonic power.

4.5 Shut down

- a) Remove all work from work holder
- b) Blow out hydrogen torch
- c) Turn off hydrogen and oxygen
- d) Turn off heaters, Ultrasonic generator, lights and machine power.

## 5.0 Maintenance

- 5.1 Lubricate bearings and bushings on all moving parts.
- 5.2 Check all hoses for wear
- 5.3 Check all exposed wiring for wear
- 5.4 Check ground daily



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			Sheet 1	Rev. 7
			Date	Jan. 26, 1978
Subject ATTACHING CORRAL TO SUBSTRATE			POC 78-6033	

5.2

# 1.0 PURPOSE:

This document outlines the requirements and process for assembling the corral to the substrate, in the Raytheon "Pin-Pak" during the second glaze firing cycle.

# 2.0 SAFETY:

Observe normal safety precautions.

# 3.0 APPLICABLE DOCUMENTS:

3.1 Firing Schedules - Furnace Profiles - O.S. 1012

3.2 O.S. 1207

# 4.0 EQUIPMENT, TOOLING, GAGES:

4.1 Furnace BTU - 3 zone set for glaze profile.

4.2 Furnace Settings - @520°-540°C, 3 1/2"/min. belt speed.

4.3 Fixtures - CMD00105-144 and CMD00105-199.

# 5.0 PRODUCT REQUIREMENTS:

5.1 Corral and substrate assembly must exhibit a tight seal of 1 X 10<sup>-8</sup> std.-cc. Helium/sec. on a Veeco check.

5.2 Visual and Dimensional Inspection of Corral/Substrate Assembly. per O.S. 1265.

# 6.0 PROCESS REQUIREMENTS:

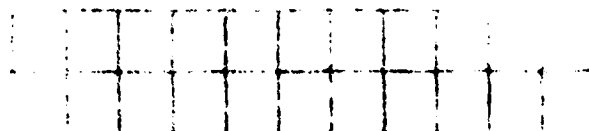
## 6.1 Pre-Operation Procedure;

6.1.1 Corrals will have presintered glass on one face per O.S. 1127 and O.S. 1207.

6.1.2 Substrates will have been cleaned per O.S. 1043.

1 1A 2 3

7 0 5 4



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		Sheet 1A	Rev. 0
		Date Jan. 26, 1978	
ATTACHING CORRAL TO SUBSTRATE		POC 78-6033	

6.0 PROCESS REQUIREMENTS:

6.1 Pre-Operation Procedure: Cont.

6.1.3 Burnish lightly with fiberglass brush. Clean per O.S.1043

Note: Type H60171A substrates which have been laser trimmed do not require burnishing prior to corral attach.

6.1.4 A sufficient number of fixtures will be on hand.

6.1.5 Clean burned in glass off fixtures once per week, using a wire brush.

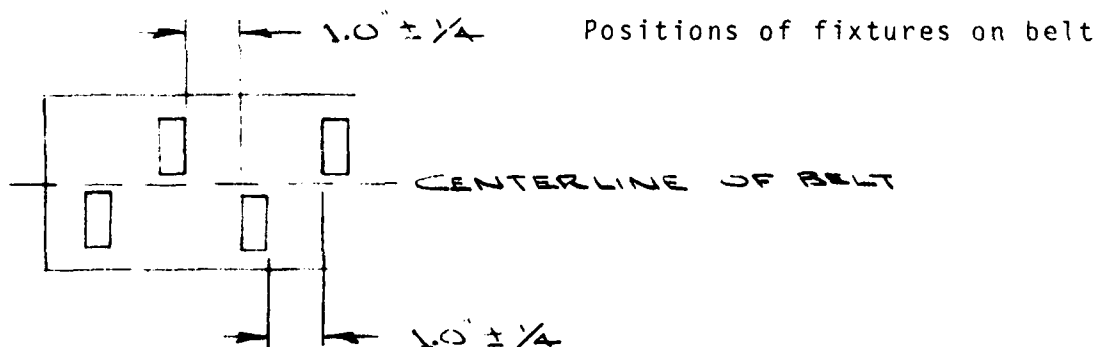


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Sheet	2	Rev. 5
Date	Dec. 23, 1974	
Subject	ATTACHING CORRAL TO SUBSTRATE	
	POC 74-6347	

6.0 PROCESS REQUIREMENTS: Cont.6.2 Operation Procedure:

- 6.2.1 Place substrate, circuit side up, in fixture, taking care that it seats within pins.
- 6.2.2 Place cover plate on fixture.
- 6.2.3 Place corral, glass side down, into recess in cover plate, making certain that it drops down flat onto substrate.
- 6.2.4 Place weight on top of corral in fixture.
- 6.2.5 Place fixture on belt one inch apart, staggered as shown in note below.



- 6.2.6 Fire at belt speed of 3 1/2 inches per minute.
- 6.2.7 When fixtures emerge from furnace, remove from belt and unload.
- 6.2.8 Inspect assemblies for fillets, holes and glass on lands.

7.0 PROCESS CONTROL:

- 7.1 Belt speed will be checked after each run.
- 7.2 A minimum sample of 10% will be visually inspected as parts are removed from belt.

8.0 QUALITY:

- 8.1 Assembled parts will be inspected and must meet requirements as outlined in Para. 5.0.

Note: At no time should parts be handled except with finger cots or tweezers.



RAYTHEON COMPANY  
INDUSTRIAL COMPONENTS DIVISION

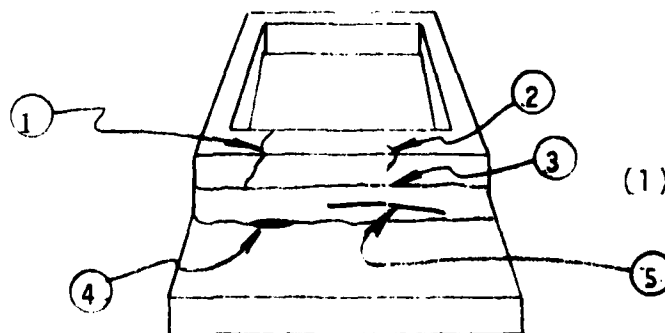
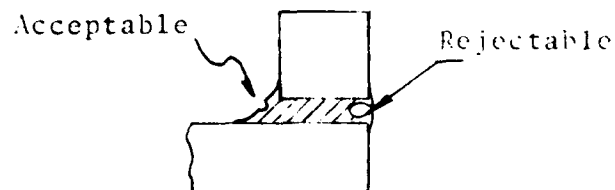
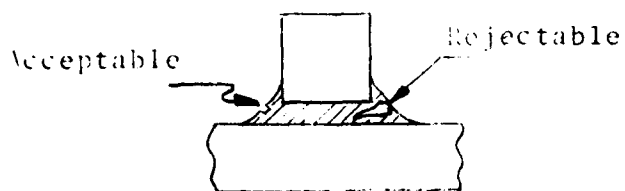
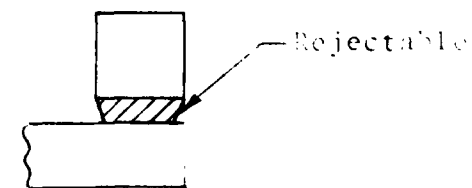
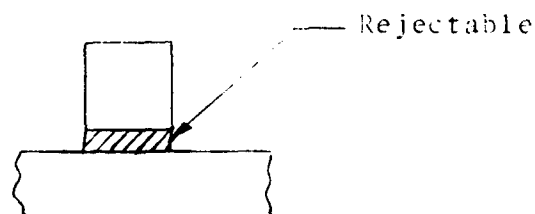
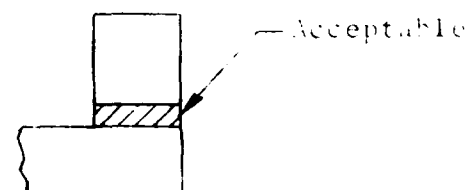
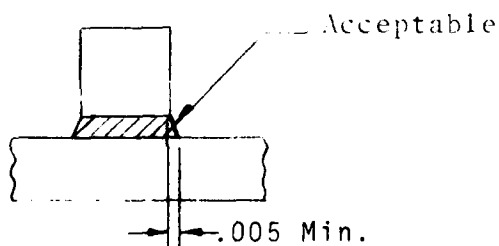
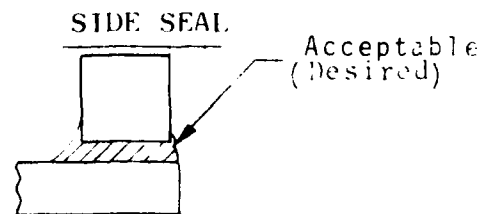
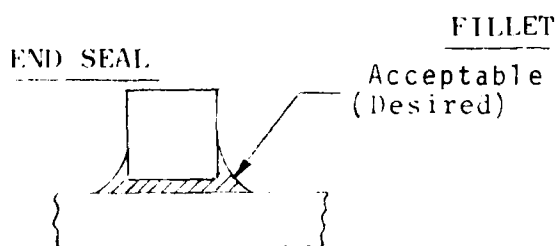
Form 20-0044

Operation Standard	1208
Sheet 3	Rev. 4
Date	Jan. 14, 1976
Subject	PO# 75-6342

Subject

ATTACHING CORRAL TO SUBSTRATE

VISUAL INSPECTION CRITERIA  
CORRAL/SUBSTRATE ASSY.




All cracks are  
REJECTABLE

- (1) & (2) Corral cracks
- (3) Fracture at glass/  
corral
- (4) Fracture at glass/  
substrate
- (5) Fillet crack



RAYTHEON COMPANY

 <b>RAYTHEON COMPANY</b>		<b>Operation Standard</b> 1222
Form 10-0015		<b>Sheet</b> 1 <b>Rev.</b> 29
<b>Subject</b> GROSS LEAK TESTS		<b>Date</b> April 5, 1980
		POC 80-4300

5.4

1.0 PURPOSE:

- 1.1 To specify a method of Gross Leak Testing hermetically sealed hybrid circuits using fluorochem FC78, FC-72, FC-48 or FC-40.

## 2.0 SAFETY:

- 2.1 Normal precautions are to be observed for handling solutions.

### 3.0 EQUIPMENT AND TOOLS:

- 3.1 Pressure/vacuum Bomb Tank 0-100 PSI and capable of less than 1 Torr.
- 3.2 Leak test station agnstromics Model #1501 or equivalent.
- 3.3 Oven 0-200°C.
- 3.4 Tweezer or holding fixture.
- 3.5 Welch Pump or equivalent
- 3.6 G.E. Vacuum gage or equivalent

#### 4.0 MATERIAL AND SUPPLIES:

- 4.1 FC-78 or FC-72 Fluorocarbon
- 4.2 FC-40 or FC-48 Fluorocarbon
- 4.3 Whatman #50 Filter paper or equivalent

## 5.0 REQUIREMENTS:

- 5.1 No bubble comes from package under test.

**6.0 PROCEDURE:** For pressure testing only. (No vacuum applied)

- 6.1 Place packages to be tested in a beaker and cover with FC-78 or FC-72.**

**NOTE: Filter FC-78 or FC-72 each time before using.**

- 6.2 Place in the pressure bomb tank and seal, and place under pressure and time as specified in Table I.

[illegible]



Form 20-0044

## RAYTHEON COMPANY

		Operation Standard	1222
		Sheet	2
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		Date	Feb. 26, 1979
Subject	GROSS LEAK TESTS		POC 79-6148

## 6.0 Cont.

- 6.3 Remove the pressure from the tank, and remove the package.
- 6.4 Pour off the FC-78 or FC-72 into a clean container.
- 6.5 Allow the packages to dry for 3 minutes.
- 6.6 Filter the FC-40 or FC-48 before using each time.
- 6.7 Place FC-40 or FC-48 in the leak test station and set the temperature at  $125^{\circ}\text{C} \pm 5^{\circ}\text{C}$ .
- 6.8 Place the package to be tested in the FC-40 or FC-48 at a depth of 2 inches below the surface for 30 seconds.
- 6.9 Look for bubbles or streams of bubbles coming from the package. If bubbles are observed the package is to be rejected. If no bubbles are observed the package is acceptable.
- 6.10 Remove from the FC-40 and dry for 5 minutes

7.0 PROCEDURE: For vacuum/pressure (Refer Fig. 2) preconditioning.  
Per MIL-STD-883B, Method 1014.2 Test Condition C.

Note: Binks tank with vacuum fittings should be used. Technician should pre-set the reduction valve to deliver the applicable pressure for the pressure application phase of this test.

- 7.1 Place packages to be tested in a <sup>250</sup> milliliter graduated beaker. Note height of packages in beaker.
- 7.2 Shut off all tank cover valves.
- 7.3 Place beaker in tank so that the FC-78 or FC-62 copper inlet tube will be positioned in the beaker when the cover is closed.
- 7.4 Seal the tank.
- 7.5 Pour approximately 300 ml FC-78 or FC-72 into a 600 ml graduated beaker.
- 7.6 Start vacuum pump.
- 7.7 Place the FC-78 or FC-72 inlet tube attached to one of the cover valves in the 600 ml FC-78 or FC-72 reservoir beaker.




RAYTHEON COMPANY

Form No. 0014

		Operation Standard	1222
		Sheet	3
		Rev.	5
		Date	Feb. 26, 1979
Subject	GROSS LEAK TESTS		POC 79-6148

7.0 PROCEDURE: Cont.

- 7.8 Open cover valve attached to vacuum line. Shut off valve after vacuum in tank is below 1,000 microns (1 torr). Allow tank to remain at 5 Torr vacuum or lower for 1 hour.
- 7.9 Open FC-78 or FC-72 inlet valve very slowly and allow FC-78 or FC-72 to enter the tank. Entry rate should be between 50 ml and 200 ml per minute. The total amount to be delivered to the tank should be pre-determined depending on the height of the packages within the tank. A quantity of FC-78 or FC-72 in addition to the calculated quantity should be delivered to the tank. This additional quantity should be about 50 milliliters and is necessary due to evaporation resulting from the applied vacuum.
- 7.10 Close FC-78 or FC-72 inlet valve after the appropriate amount has been delivered.
- 7.11 Relieve vacuum by opening vent valve.
- 7.12 Close pressure vent by valve.
- 7.13 Open Hi Pressure valve and allow tank to attain the specified pressure. (See Table I).
- 7.14 Hold chamber under this pressure for the specified time. (See Table I).
- 7.15 At the end of this time, the pressure shall be released and the devices removed from the pressure chamber.
- 7.16 Pour off the FC-72 or FC-78 into its respective container through a filter capable of removing particles greater than one micron.
- 7.17 Allow the devices to air dry for  $2 \pm 1$  minutes prior to immersion in FC-40 or FC-48.
- 7.18 Place FC-40 or FC-48 in a leak station and set the temperature at  $125^{\circ}\text{C} \pm 5^{\circ}\text{C}$ . The station shall have a lighting source capable of producing at least 15 thousand foot candles in air.
- 7.19 Place the device to be tested in the FC-40 or FC-48 at a depth of 2 inches below the surface for 30 seconds.

 <b>RAYTHEON COMPANY</b>		<b>Operation Standard</b> 1222	
		<b>Sheet</b> 4	<b>Rev.</b> 7
		<b>Date</b> Feb. 26, 1979	
<b>Subject</b> GROSS LEAK TEST		POC 79-6148	

7.0 PROCEDURE: Cont

7.20 Observe the device against a dull, non-reflective black background through the magnifier. A definite stream of bubbles or two or more large bubbles originating from the same point shall be cause for rejection.

7.21 Remove the device from the FC-40 or FC-48 and allow to dry for 5 minutes.

8.0 PROCEDURE: (No Pressurizing)

8.1 Fill beaker to 825 cc with filtered FC-40.

8.2 Turn hot plate on and heat FC-40 to  $125^{\circ} \pm 5^{\circ}$ .

8.3 Clean modules of all foreign matter.

8.4 Evenly place 9 units on stainless steel holding fixture.

8.5 Place holding fixture into FC-40 and place hooks of fixture over edge of beaker.

8.6 Observe units for 1 minute. If bubbles are observed the unit is rejected and marked.

8.7 After units removed from the FC-40 units should be cleaned and dried.

9.0 INSPECTION:

9.1 Packages are dry

9.2 Gross Leaks are marked

10.0 PROCEDURE PARAGRAPH AND CONDITIONS: See Page 5

11.0 PROCEDURE: Cont.

Northrop devices subjected to this examination shall be immersed, with the uppermost portion at a minimum depth of 2 inches below the surface of the indicator fluid, one at a time (or in such a configuration that bubbles from a single device out of a group under observation may be clearly observed as to their occurrences and source), in the leak indicator maintained at  $125 \pm 5^{\circ}\text{C}$ . Each device shall be observed from the instant of immersion until 30 seconds after immersion, unless bubbles occur earlier.





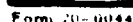
RAYTHEON COMPANY

Form 20-0044

Operation Standard	1222	
Sheet	5	Rev. .11
Date	Feb. 26, 1979	
Subject	POC 79-6148	

TABLE I

Module Type	Exposure Pressure (Pounds)	Pressure Relief Valve Setting	Exposure Time (Hours)	Procedure	Exposure Vacuum
		65	3	Par. 6	
		35	1		
		35	1		
		35	1		
		13	4		
		35	1		
		35	3	Par. 6	
		13	4	Par. 7	<5 torr
		65	3	Par. 6	
		65	3	Par. 6	
		65	3	" 6	
		65	3	" 6	
		35	2	Par. 7	
		35	2	Par. 6	<5 torr
		N/A	N/A	Par. 8	
		N/A	N/A	Par. 8	
		N/A	N/A	Par. 8	
		N/A	N/A	Par. 8	



RAYTHEON COMPANY

Operation Standard		1222
Sheet	6	Rev. 6
Date May 1, 1979		
POC 79-6363		

TABLE I

[illegible]

 <b>RAYTHEON COMPANY</b>		<b>Operation Standard</b> 1222	
Form 20-0044		<b>Sheet</b> 7	<b>Rev.</b> 2
<b>Subject</b> GROSS LEAK TESTS		<b>Date</b> April 5, 1980	
		POC 80-4300	

TABLE I

Module Type	Exposure Pressure (Pounds)	Pressure Relief Valve Setting	Exposure Time (Hours)	Procedure	Exposure Vacuum
H60372 H60373 H60374 H60375 H60378 H60379	60	65	3	Par. 7	<5 Torr
H60389 H60390 H60391 H60392	60	65	3	Par. 7	<5 Torr
H60393	30	—	1	Par. 6	—
H60394	10	—	4	Par. 6	—
H60380 H60383 H60384	60	65	3	Par 6	—
H60243 (Corral Only)	60	65	3	Par. 6	NA See note 1
H60243 (Case)	15	20	4	Par. 6	NA See note 1
Note 1: The operator must be grounded at all times when handling these units.					
H60414	60	65	2hrs min.	Par. 6	
H60396	60	65	2hrs	Par. 6	
H60460	60	65	2hrs	Par. 6	
H60451,	N/A	N/A	N/A	Par. 11	N/A
H60452	N/A	N/A	N/A	Par. 11	N/A
H60410	30psig	33psi	10hrs	Para. 7	<5 Torr
H60508	45	50	2	Para. 7	5 See Note 1
H60509	45	50	2	Para. 7	5 See Note 1



RAYTHEON COMPANY

Form 20-0044

Operation Standard	1222
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Rev.	0
Date	2-26-79
Subject	POC 79-6148

Subject

GROSS LEAK TESTS

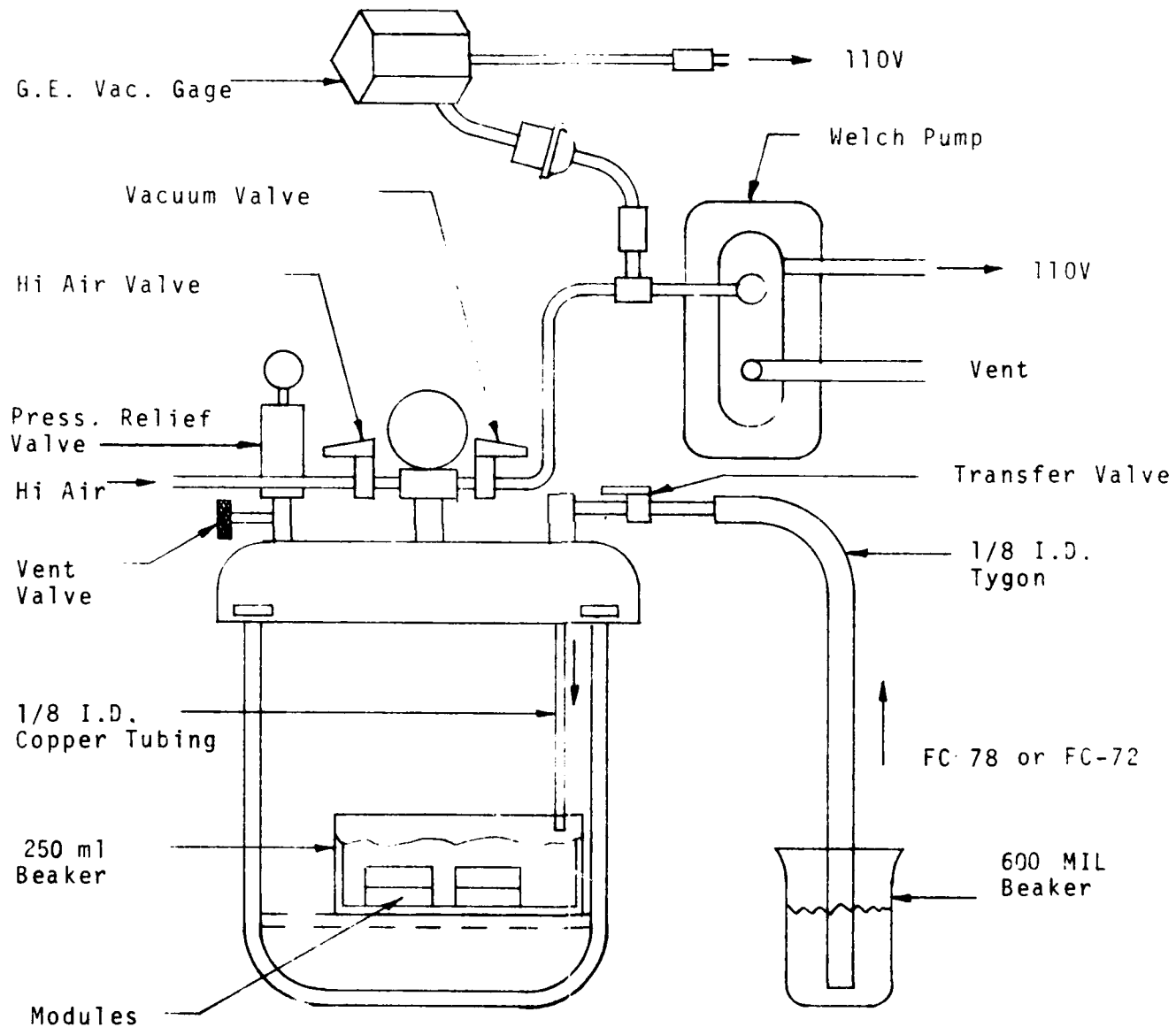


Fig. II



Form 20-6044

**RAYTHEON COMPANY**

Operation Standard		1229
Sheet	1	Rev. 31
Date August 10, 1979		
POC 79-6576		

## 1.0 PURPOSE:

To specify a method of testing the leak rate of hermetically sealed hybrid circuits using a Helium Leak Detector.

## 2.0 SAFETY:

2.1 Normal precautions; no unusual hazards exist.

### 3.0 APPLICABLE DOCUMENTS:

### 3.1 Test methods and procedures for Microelectronics - MIL-STD-883, Method 1014.

3.2 Veeco Instruments Inc. Operation and Maintenance Manual for appropriate model.

#### 4.0 EQUIPMENT AND TOOLS:

4.1 Veeco Mass Spectrometer Leak Test Station, MS-12, MS 17AB or equivalent.

#### 4.2 Sensitivity Calibrator Type SC-4 or equivalent.

4.3 Pressure Tank, fitted with a helium inlet port and release valve; tank to withstand 100 p.s.i.g. pressure.

## 5.0 MATERIALS' AND' SUPPLIES:

### 5.1 Helium tank

## 5.2 Circuits to be tested

## 6.0 REQUIREMENT:

6.1 No helium leaks beyond limits as listed in Table I.

## 7.0 PROCESS PROCEDURE:

### 7.1 Pre-Operation Procedure:

7.1.1 Sensitivity Check: The sensitivity check must be made using the air equivalent leak rate figure printed on the SC-4 type Sensitivity Calibrator.

[illegible]



RAYTHEON COMPANY

Form 20-0044

Operation Standard	1229
Sheet 2	Rev. 3
Date	April 23, 1975
Subject	POC 75-6095

Subject  
HELIUM LEAK TEST

## 7.0 Cont.

## 7.1.1 Cont.

The procedure for this check should be in accordance with the pertinent manual. This check must be performed before using the equipment for leak testing, and repeated at reasonable intervals (at least every 4 hours) during the day and at the end of the day. If sensitivity is incorrect, refer to Manual for correction/calibration procedure.

(Note: Usually addition of liquid nitrogen to cold trap returns sensitivity to desired level)

7.1.2 Pressurization of Circuits with Helium:

7.1.2.1 The units to be tested shall be placed in a suitable container inside the pressure tanks and the tank capped tight.

7.1.2.1.1 For units requiring 60 p.s.i.g. pressurization (Table I), check to see that the helium tank pressure is at 60 p.s.i.g.

7.1.2.1.2 Open the valve to the pressure tank. Then slowly open the release valve until escaping gas is heard (not a rapid venting), vent for 4-5 seconds and close the release valve; then repeat. The pressurization shall then be maintained for the required exposure time.

7.1.2.1.3 For units requiring other pressures, adjust pressure regulator to desired level, (Table I); then follow procedure of 7.1.2.1.2 above.

7.1.2.2 At the end of the exposure time, the helium pressure port shall be closed, the release valve opened and the units removed.

7.1.2.3 The units are now to be leak tested within the time limit specified in Table I.

7.2 Testing Procedure:

7.2.1 The helium leak detector must have been checked and operating in AUTOMATIC mode for at least 1/2 hour prior to testing. Push the pump switch to VENT, remove the manifold plug and insert the appropriate test plug into the manifold chamber.



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3

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HELIUM LEAK TEST

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## 7.0 Cont.

- 7.2.2 Place unit(s) to be tested in the gasketed tube and insert into test plug.
- 7.2.3 Press the FILAMENT EMISSION "ON" switch, if it is not already ON.
- 7.2.4 Switch the LEAK INDICATOR knob to the required SCALE for the particular device(s) being tested.
- 7.2.5 Push the pump switch to START and wait until the TEST light on the LEAK INDICATOR comes on (usually 15-25 sec.); then read the LEAK RATE.
- 7.2.6 Units that read greater than the test limits in TABLE I shall be classified as leakers.
- 7.2.7 Push the switch to VENT and remove the unit(s).
- 7.2.8 Repeat for additional circuits.
- 7.2.9 Special Cases:
- 7.2.9.1 If the TEST light does not come on in a reasonable time, i.e., within 30 seconds of pushing START switch, there is either a large leaker or a leak in the system. If the FILAMENT EMISSION light flips off, the same conditions could exist. If either of these conditions occur, immediately push/to VENT; then check for leaks in the system and repeat the test on the unit(s); if the same conditions happen again, VENT and remove the unit(s) under test which shall then be classified as leaker(s).
- 7.2.9.2 If, when the TEST light comes on, the indicator needle slams off-scale, immediately push switch to VENT and remove the unit. The unit under test shall be classified as a leaker.
- 7.2.9.3 When testing more than one unit at a time, if there is an indication of a leaker or the conditions described in 7.2.9.1 and 7.2.9.2 then the batch shall be immediately retested one unit at a time to find the leaker(s).

Note:

When finished testing the lot(s), replace the manifold plug and push switch to start.



RAYTHEON COMPANY

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Sheet 4	Rev. 0
Date April 23, 1975	
Subject HELIUM LEAK TEST	POC 75-6095

8.0 MAINTENANCE:

- 8.1 Refer to Leak Detector Manual for General Maintenance
- 8.2 Start-Up:
  - 8.2.1 Turn on ELECTRONICS switch.
  - 8.2.2 Fill the cold trap with liquid nitrogen.
  - 8.2.3 Turn the FILAMENT EMISSION switch ON.
  - 8.2.4 Allow the leak detector to operate for 1/2 hour before starting to check sensitivity.
- 8.3 Run sensitivity check at start of each day, and at intervals no greater than 4 hrs., plus at the end of the day.
  - 8.3.1 Push switch to VENT, remove manifold plug and insert Sensitivity Calibrator TYPE SC-4 into manifold.
  - 8.3.2 Turn leak indicator knob to the scale corresponding to the Air Equivalent Leak Rate, in STD. cc/sec. as printed on the SC-4 calibrator
  - 8.3.3 The calibrator valve, even when not being used for sensitivity check, should be fully opened; check to be certain this is the case.
  - 8.3.4 Push switch to START and follow SENSITIVITY CHECK procedure of Manual.
- 8.4 Check helium pressure tank supply; also, weekly or as indicated, check for leaks in vacuum-pressure tanks.
- 8.5 Shut-Down:
  - 8.5.1 Place metal plug into manifold.
  - 8.5.2 Have switch in START position, with vacuum indicator needle below the red indication area.
  - 8.5.3 Turn off the FILAMENT EMISSION switch.
  - 8.5.4 Turn off the ELECTRONICS switch.





RAYTHEON COMPANY

Form 20-0044

Operation Standard 1229	
Sheet 5	Rev. 15
Date April 9, 1979	
POC 79-6269	

Subject

HELIUM LEAK TEST

TABLE I

HERMETICITY TEST CONDITIONS & LIMITS

## Exposure to Helium

<u>Program</u>	<u>Module Type No.</u>	<u>Pressure</u>	<u>Time</u>	<u>Dwell Time Max.</u>	<u>Test Limit, Max. Measured Leak Rate cc/sec. He</u>
		60	30-40 Min.	90 Min.	$5 \times 10^{-7}$
		60	16 Hrs. +	90 Min.	$3 \times 10^{-6}$
		60	16 Hrs. +	90 Min.	$3 \times 10^{-6}$
		60	2 Hrs.	30 Min.	$5 \times 10^{-7}$
		60	30-40 Min.	90 Min.	$5 \times 10^{-7}$
		60	16 Hrs. +	90 Min.	$3 \times 10^{-6}$
		60	30-40 Min.	90 Min.	$4 \times 10^{-7}$
		60	16 Hrs. +	90 Min.	$3 \times 10^{-6}$
		60	3-4 Hrs.	35 Min.	$1 \times 10^{-8}$
		30	30-40 Min.	90 Min.	$1 \times 10^{-6}$
		30	16 Hrs. +	90 Min.	$2 \times 10^{-6}$
		10	16 Hrs. +	90 Min.	$3 \times 10^{-6}$
		10			
		10	4 Hr.	60 Min.	$5 \times 10^{-7}$
		10	4 Hrs.	60 Min.	$5 \times 10^{-7}$
		60	2 Hrs.	90 Min.	$5 \times 10^{-7}$
		60	12 Hrs.	90 Min.	$3 \times 10^{-6}$
		60	60 Min.	30 Min.	$5 \times 10^{-7}$
			Max.	Max.	
		60	2 Hrs	1 Hr.	$5 \times 10^{-7}$



RAYTHEON COMPANY

Form 20-0044

Operation Standard	1229	
Sheet	6	Rev. 7
Date	August 10, 1979	
Subject	POC 79-6576	

PROGRAM	MODULE TYPE NO.	PRESSURE	TIME	DWELL TIME MAX.	Test Limit, Max. Measured Leak Rate cc/sec. He
		60	2 Hrs.	30 Min.	$5 \times 10^{-7}$
		60	2 Hrs.	30 Min.	$5 \times 10^{-7}$
		60	1 Hr.	60 Min.	$4 \times 10^{-7}$
		30	4	60 Min.	$5 \times 10^{-7}$
		10	4	60 Min.	$x 10^{-7}$
		30	1 Hr.	60 Min.	$1 \times 10^{-8}$
		30	3 Hrs.	60 Min.	$1 \times 10^{-8}$
		30	1 Hr.	60 Min.	$1 \times 10^{-8}$
		30	1 Hr.	60 Min.	$1 \times 10^{-8}$
		30	1 Hr.	60 Min.	$1 \times 10^{-8}$
		30	1 Hr.	60 Min.	$1 \times 10^{-8}$
		30	1 Hr.	60 Min.	$1 \times 10^{-8}$
		30	3 Hrs.	60 Min.	$1 \times 10^{-8}$
		30	1 Hr.	60 Min.	$1 \times 10^{-8}$
		30	1 Hr.	60 Min.	$1 \times 10^{-8}$
		30	1 Hr.	60 Min.	$1 \times 10^{-8}$
		30	1 Hr.	60 Min.	$1 \times 10^{-8}$

This is the max. time within which all units in the lot exposed to helium must be tested in the leak detector after removal from pressurization cycle.

\*\*For Q.C. Final Test Only.

\*Alternate Fine Leak Test for all Santa Barbara.

After removing from pressurizing bomb and before Leak Test, flush parts with dry nitrogen for 30 seconds minimum.

30	2 Hrs.	90 Min.	$5 \times 10^{-7}$	
60	2 Hr.	90 Min.	$5 \times 10^{-7}$	
60	2 Hrs.	60 Min.	$1 \times 10^{-8}$	
↓	↓	↓	↓	
60	2 Hrs.	90 Min.	$5 \times 10^{-7}$	
60	12 Hrs.	OR 90 Min.	$3 \times 10^{-6}$	
60	2 Hrs.	60 Min.	$5 \times 10^{-7}$	See Note 1
15	4 Hrs.	60 Min.	$5 \times 10^{-7}$	See Note 1

NOTE: Operator must be grounded and a deionizing blower must be used. It shall be aimed at the test plug and be not more than 2 ft. away.



RAYTHEON COMPANY

Form 20-0644

Operation Standard 1229	
Sheet 7	Rev. 5
Date June 5, 1979	
POC 79-6442	

Subject

HELIUM LEAK TESTS

PROGRAM	MODULE TYPE NO.	PRESSURE	TIME	DWELL TIME MAX.	TEST LIMIT, MAX. MEASURED LEAK RATE cc/Sec. He
		60 lbs.	16 Hrs.	90 Min.	$1 \times 10^{-8}$
		15 Psig	16 Hrs.	1 Hr.	$5 \times 10^{-7}$
		30 Psig	5 Hrs.	60 Min.	$1 \times 10^{-7}$
		↓	3 Hrs.	↓	↓
		↓	3 Hrs.	↓	↓
		↓	3 Hrs.	↓	↓
		↓	3 Hrs.	↓	↓
		60 Psig	5 Hrs.	30 Min.	$2 \times 10^{-8}$
		↓	↓	↓	↓
		0 Psig	2 Hrs.	30 Min.	$2.4 \times 10^{-7}$
		↓	↓	↓	↓
ECOM	H60388	↓	↓	↓	↓
(32157-3)	TCFG	30 Psig	2.5 Hrs.	30 Min.	$2.2 \times 10^{-7}$
(32157-1)	VCX0	30 Psig	4 Hrs.	30 Min.	$2 \times 10^{-7}$
		30 Psig	2 Hrs.	30 Min.	$2.4 \times 10^{-7}$
		↓	↓	↓	↓
		↓	↓	↓	↓
		↓	↓	↓	↓
		30psi	4hr.	1hr.	$5 \times 10^{-7}$ cc/sec



Operation Standard		1250
Sheet	1	Rev. 1
Date Aug. 13, 1974		
POC 74-6193		

## 1.0 SCOPE:

This instruction details the inspection procedure to be followed in performing resistor trimming In-Process Inspections. All operating machines producing regular production substrates are covered by this procedure.

## 2.0 APPLICABLE DOCUMENTS:

- 2.1 O.S. 1018 - Resistor Trimming Procedure
- 2.2 Applicable screened substrate drawing.

### 5.0 EQUIPMENT:

- 5.1 Microscope 10X to 30X stereozoom or equivalent.
- 5.2 Six (6) place digital multifunction meter or equivalent.

#### 4.0 FREQUENCY OF INSPECTION:

- 4.1 "Set-Up-Check" - Start of shift and change overs.  
4.2 "In-Process" - Every half hour of operation.

## 5.0 SAMPLE SIZE:

Five (5) substrates to be drawn from most recent production.

## 6.0 AREAS TO BE INSPECTED:

### 6.1 Electrical:

Resistor being trimmed and all other previously trimmed resistors which have a tolerance band of  $\pm 1\%$  or less and are within  $1/4$  inch of the resistor being trimmed.

## 6.2 Visual:

- 6.2.1 Resistor being trimmed and adjacent areas.
- 6.2.2 Probe point areas (Use backlighting)
- 6.2.3 Entire substrate area for overview

[illegible]



RAYTHEON COMPANY  
INDUSTRIAL COMPONENTS DIVISION

Operation Standard	1252	
Sheet	2	Rev. 1
Date	Aug. 13, 1974	
Subject	IN-PROCESS INSPECTION RESISTOR TRIMMING	
	POC 74-6195	

7.0 DISPOSITION:

If a defect is found in the sample the process shall be shut down and corrective action taken. The process may not continue until a subsequent sample is approved. The inspector shall report any incidence of non-compliance with this provision to the inspection foreman.

8.0 RECORDING OF DATA:

Electrical and Visual Inspection data shall be recorded on the data sheet of Appendix A.

9.0 CRITERIA:

9.1 Electrical:

Resistance values shall be within the specified "post trim" limits guard banded to 80% of the total range.

9.2 Visual:

9.2.1 Check to 200, 300 and 400 series criteria of O.S. 1265 and also items 501 and 504 (Glaze overcoat) of O.S. 1265.

Appendix 1

PROGRAM \_\_\_\_\_ H \_\_\_\_\_ DWG. NO. \_\_\_\_\_

[illegible]



RAYTHEON COMPANY

Form 9-0044

Subject

PULL TEST INSPECTION

Operation  
Standard

1253

Sheet

1

Rev.

23

Date

Nov. 27, 1979

POC 79-6907

*John D. Davis*

## 1.0 SCOPE:

This instruction details inspection procedures to be followed in performance of Wire Bond In-Process Inspection.

## 2.0 APPLICABLE DOCUMENTS:

- 2.1 100% visual per MIL-STD-883, Method 2010.2, Condition A for I.C.'s and MIL-STD-750B, Method 2072 for transistors and diodes.

## 3.0 EQUIPMENT:

- 3.1 Microscope B L 31-26-94 or equivalent.
- 3.2 Microscope, Metallurgical B L DMET-31-20-37 ro equivalent.
- 3.3 Non-destructive wire bond pull tester, Mech-EI or equivalent.

## 4.0 GENERAL PROCEDURE:

- 4.1 The Q.C. Inspector will obtain the required sample for visual inspection and pull test as specified for each program in the attached appendices. The sampling must be spaced evenly throughout the lot run and must include a piece at the start of each shift; a piece after a stop condition. Before performing the wire bond pull test, visually inspect all bonds at 30 to 50X magnification in accordance with the criteria in O.S. 1265. Major defects as those defined in Paragraphs 3.1, 3.4, 3.5, 3.6, and 3.7. All other defects are considered minor, for In-Process Wire Bond Inspection. Disposition of the sample is in accordance with the applicable appendix. Unless specified otherwise, pull test all wires on all modules even if they are visual rejects. Identify visually rejected bonds on the pull test data sheets.
- 4.2 Machine Shutdown - When a stop condition is reached the Q.C. Inspector will notify the production foreman to stop the operation and take corrective action. The process engineer must approve machine operation before wire bonding is resumed. The Process Engineer will record the action taken and initial approval on the pull test data sheet. The Q.C. Inspector will then resume sampling with the first piece off the machine.

	1	2	3	4	5	5A	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	23	9	1	1	2	1	2	1	1	1	1	1	1	1	2	0	0	0	0	0	0	0



RAYTHEON COMPANY

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Subject	PULL TEST INSPECTION OF WIRE BOND OPERATION
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4.0 GENERAL PROCEDURE: Cont.

4.2 Cont.

The Process Engineer will record the action taken and initial approval on the pull test data sheet. The Q.C. Inspector will then resume sampling with the first piece off the machine.

If all failures are ball bond lifts on a particular chip type and the Q.C. Engineer and Process Engineer approve by recording on the pull test data sheet, continue processing and sampling but mark the lot for 100% pull test of that chip type. If the same chip type fails on subsequent samples of that lot it is not necessary to use re-sample procedure.

- 4.3 100% Pull Test - If all wire bond failures are ball lifts on one chip type, 100% pull all chips of that type, If the wire bond failures occur on different chip types, 100% pull test all chips.

All module failures from 100% pull test will be reviewed by the Q.C. Engineer and Process Engineer to determine repair action and disposition.

- 4.4 Sample pull test after 100% pull test and repair.

Resample all modules subjected to repair to the sample size specified in the individual appendices.



APPENDIX 1

TPN 19

SAMPLE SIZE - 2 MODULE PER LOT OR 2 PER SHIFT WHICHEVER IS GREATER

VISUAL INSPECTION		ACCEPT	STOP	RESAMPLE	LOT DISPOSITION
<b>1st Sample</b>					
(a) 0 Major Rejects		X			Accept
1 Major Reject				X	
2 or More Major Rejects			X		100% Inspect & Repair Modules made to this time-take corrective action.
1 or More Rejects					NOTIFY FOREMAN TO TAKE CORRECTIVE ACTION
<b>Resample - 1 Module</b>					
(b) 0 Major Rejects		X			Accept
1 or More Major Rejects			X		100% Inspect & Repair Modules made to this time-take corrective action.
1 or More Minor Rejects					NOTIFY FOREMAN TO TAKE CORRECTIVE ACTION
<b>Repeat on 2nd thru Final Sample</b>					
<b>Pull Test - 3 Grams All Wires</b>					
<b>1st Sample</b>					
(a) 0 Rejects 3 Grams		X			Accept
1 Reject 3 Grams				X	
2 or More Rejects			X		100% Pull Test to 2 Grams & Repair Modules made to this time-take corrective action.
3 Grams					
<b>Resample - 1 Module</b>					
(b) 0 Rejects 3 Grams		X			Accept
1 or more Rejects					
3 Grams			X		100% Pull Test to 2 Grams & Repair Module made to this time-take corrective action.
<b>2nd thru Final Sample</b>					
IF NO FAILURES HAVE OCCURRED - SAME AS 1st SAMPLE					
<b>2nd thru Final Sample</b>					
IF 1 REJECT WAS PREVIOUSLY FOUND:					
0 Rejects 3 Grams		X			Accept
1 or More Rejects					
3 Grams			X		100% Pull Test to 2 Grams & Repair Module made to this time-take corrective action.
3 Grams					

APPENDIX 2  
 HAWK - IN-PROCESS

SAMPLE SIZE - 5 MODULES PER LOT OR 2 PER SHIFT WHICHEVER IS GREATER

VISUAL INSPECTION	ACCEPT	STOP	RESAMPLE	LOT DISPOSITION
1st Sample				
(a) 0 Major Reject	X			Accept
1 Major Reject			X	
2 or more Major Rejects		X		100% Inspect & Repair Modules made to this time-take corrective action
1 or More Minor Rejects	NOTIFY FOREMAN TO TAKE CORRECTION ACTION			
Resample - 1 Module				
(b) 0 Major Reject	X			Accept
1 or More Major Rejects		X		100% Inspect & Repair Modules made to this time-take correction action.
1 or More Minor Rejects	NOTIFY FOREMAN TO TAKE CORRECTIVE ACTION			
Repeat for 2nd - 5th Sample				
PULL TEST - 3 GRAMS - ALL WIRES				
1st Sample				
(a) 0 Rejects <3 Grams	X			Accept
1 Reject <3 Grams			X	
2 Rejects or More <3 Grams		X		100% Pull Test to 2 Grams & Repair Modules made to this time-take corrective action
Resample - 2 Modules				
(b) 0 Rejects <3 Grams	X			Accept
1 or More Rejects <3 Grams		X		100% Pull Test to 2.0 Grams & Repair Modules made to this time-take corrective action
2nd thru 5th Sample				
IF NO FAILURES HAVE OCCURRED - SAME AS 1ST SAMPLE				
2nd thru 5th Sample				
IF 1 REJECT WAS PREVIOUSLY FOUND:				
0 Rejects <3 Grams	X			Accept
1 or More Rejects <3 Grams		X		100% Pull Test to 2.0 Grams & Repair Modules make to this time-take corrective action

H60282, #H60283 and #H60296 SEA SPARROW AND OTHERS UNLESS OTHERWISE SPECIFIED

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June 28, 1978

SAMPLE SIZE - 2 MODULES PER LOT OR 2 PER SHIFT SHICHEVER IS GREATER

VISUAL INSPECTION		ACCEPT	STOP	RESAMPLE	LOT DISPOSITION
<b>1st Sample</b>					
(a)	0 Major Reject	X			Accept
	1 Major Reject			X	
	2 or More Major Rejects		X		100% Inspect & Repair Modules made to this time-take corrective action.
	1 or More Minor Rejects				NOTIFY FOREMAN TO TAKE CORRECTIVE ACTION
<b>Resample - 1 Module</b>					
(b)	0 Major Rejects	X			Accept
	1 or More Major Rejects		X		100% Inspect & Repair Modules mad to this time-take corrective action.
	1 or More Minor Rejects				NOTIFY FOREMAN TO TAKE CORRECTIVE ACTION
	Repeat on 2nd thru Final Sample				
<b>Pull Test - 3 Grams - All Wires</b>					
<b>1st Sample</b>					
(a)	0 Rejects < 1 Gram	X			Accept
	1 Reject < 1 Gram		X		100% Pull Test to 2 Grams, and Repair all Modules made to this time-take corrective action.
	2 Rejects > 1 Gram < 3 Grams	X			Accept
	3 Rejects > 1 Gram < 3 Grams			X	
	4 Reject > 1 Gram < 3 Grams		X		100% Pull Test to 2 Grams, and Repair all Modules made to this time-take corrective action.
<b>Resample - 1 Module</b>					
(b)	0 Rejects < 1 Gram	X			Accept
	1 Rejects < 1 Gram		X		100% Pull Test to 2 Grams, and Repair all Modules made to this time-take corrective action.
	1 Reject > 1 Gram < 3 Grams	X			Accept
	2 or More Rejects > 1 Gram < 3 Grams		X		100% Pull Test to 2 Grams, and Repair all Modules made to this time-take corrective action.

2nd thru Final Sample

SAME AS 1ST SAMPLE

\* Pull Test 30 wires at random per module.

# See Notes 1 and 2 on Page 5A

APPENDIX 3

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Note 1.

H60296 - Pull test Q2E and Q4E to 2 grams. All other bonds pull test to 3 grams.

Note 2

H60283 - Pull Test Q1 and Q2 to 2 grams. All other wires pull to 3 grams.

APPENDIX 4  
ARCO - IN-PROCESS

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June 28, 1978

SAMPLE SIZE 10 FLATPAKS PER LOT OR 4 PER SHIFT WHICHEVER IS GREATER

Visual Inspection

LOT DISPOSITION

ACCEPT STOP RESAMPLE

1st Sample	1 Flatpak				
(a) 0 Major Reject		X			Accept
1 Major Reject				X	
2 or More Major Rejects			X		100% Inspect & Repair Modules made to this time-take corrective action. NOTIFY FOREMAN TO TAKE CORRECTIVE ACTION
1 or More Rejects					

Resample - 1 Flatpak					
(b) 0 Major Rejects		X			Accept
1 or More Major Rejects			X		100% Inspect & Repair Modules made to this time-take corrective action. CORRECTIVE ACTION
1 or More Minor Rejects					
Repeat on 2nd thru Final Sample					NOTIFY FOREMAN TO TAKE CORRECTIVE ACTION

Pull Test - 1 Grams - All Wires

All Samples					
(a) 0 Rejects - 1 Gram					Accept
1 or More Rejects					
≤ 1 Gram					100% Pull Test to 1 Gram & repair Modules made to this time-take corrective action.

Note 1: Check each flatpak that has been pull tested for 3 Mil minimum clearance from top of loop to op of seal ring. Reject flatpaks that fail this check.

Note 2: On each lot or flatpaks pull 1 sample to destruction and record breaking strength and failure mode. Plot on a control chart (Histogram). Release all lots with no failures 3.0 grams. Q.C. Engineer to approve all lots with any failures ≤ 3.0 grams by signing off the plot for that lot prior to Pre-Seal Visual Lot Acceptance.

Note 3: Pull test all flatpak seal test rejects to destruction. Record breaking strength and failure mode. Give 1 copy of data to Q.C. Engineer and Process Engineer.

# APPENDIX 5

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1160191 - SANTA BARBARA

## VISUALLY INSPECT AND PULL TEST EACH MODULE

### Visual Inspection

Notify Production Foreman to take Corrective Action.  
 Return for Repair after Pull Test.

### Pull Test - 2 Grams

Pull 30 Wires per Module  
 Pull minimum of 2 wires per Chip

### Accept Stop Resample Module Disposition

1st Sample				
0 <2 Grams	X			
1 or more Rejects <1 Grams		X		100% Pull Test to 2 Grams and Repair Take Corrective Action
1 or 2 Rejects >1 Gram <2 Grams			X	Pull 30 more wires
More than 2 Rejects >1 Grams <2 Grams			X	100% Pull Test to 2 Grams and Repair Take Corrective Action
2nd Sample				
0 Rejects <2 Grams	X			
1 or more Rejects <2 Grams		X		100% Pull Test to 2 Grams Take Corrective Action

APPENDIX 6  
H61110 - COSSOR

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SAMPLE SIZE - 2 MODULES PER LOT OR 2 PER SHIFT WHICHEVER IS GREATER

VISUAL INSPECTION	ACCEPT	STOP	RESAMPLE	LOT DISPOSITION
1st Sample				
(a) 0 Major Reject	X			Accept
1 Major Reject			X	
2 or More Major Rejects		X		100% Inspect & Repair Modules made to this time-take corrective action.
1 or More Minor Rejects				NOTIFY FOREMAN TO TAKE CORRECTIVE ACTION
Resample - 1 Module				
(b) 0 Major Rejects	X			Accept
1 or More Major Rejects		X		100% Inspect & Repair Modules made to this time-take corrective action.
Repeat on 2nd thru Final Sample				NOTIFY FOREMAN TO TAKE CORRECTIVE ACTION.
Pull Test - 2 Grams - All Wires				
1st Sample				
(a) 0 Rejects <1 Gram	X			Accept
1 Reject <1 Gram		X		100% Pull Test to 2 Grams and Repair all Modules made to this time-take Corrective Action.
2 Reject >1 Gram				
<2 Grams	X			Accept
3 Rejects >1 Gram				
<2 Grams			X	
4 Rejects >1 Gram				
<2 Grams		X		
Resample - 1 Module				
(b) 0 Rejects <1 Gram	X			Accept
1 Reject <1 Gram		X		100% Pull Test to 2 Grams & Repair Modules made to this time-take corrective action.
1 Reject >1 Gram			X	Accept
<2 Grams				
2 or More Rejects			X	100% Pull Test to 2 Grams & Repair all Modules made to this time-take Corrective Action
>1 Gram				
<2 Grams				
2nd thru Final Sample				SAME AS 1ST SAMPLE

APPENDIX 7

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H60232, H60233, H60234 Aerojet

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SAMPLE SIZE - 2 MODULES PER LOT OR 2 PER SHIFT WHICHEVER IS GREATER

LOT DISPOSITION

VISUAL INSPECTION ACCEPT STOP RESAMPLE

1st Sample

(a) 0 Major Rejects X

1 Major Reject

2 or More Major Rejects X

1 or More Minor Rejects

Accept

100% Inspect & Repair Modules made to this time-take corrective action.

NOTIFY FOREMAN TO TAKE CORRECTIVE ACTION

Resample - 1 Module

(b) 0 Major Rejects X

1 or More Major Rejects X

1 or More Minor Rejects

Repeat on 2nd thru Final Sample

Accept

100% Inspect & Repair Modules made to this time-take corrective action.

NOTIFY FOREMAN TO TAKE CORRECTIVE ACTION

Pull Test - 2 Grams - All Wires

1st Sample

(a) 0 Rejects 2 Grams X

1 Reject 2 Grams

2 Rejects 2 Grams X

Accept

100% Pull Test to 2 Grams and Repair all Modules made to this time-take corrective action.

Resample - 2 Modules

(b) 0 Rejects 2 Grams X

1 Rejects 2 Grams

Accept

100% Pull Test to 2 Grams and Repair all Modules made to this time-take corrective action.



APPENDIX 8

H60608 Series

SAMPLE SIZE - 2 MODULE PER LOT OR 2 PER SHIFT WHICHEVER IS GREATER

VISUAL INSPECTION	ACCEPT	STOP	RESAMPLE	LOT DISPOSITION
1st Sample (a) 0 Major Rejects 1 Major Reject	X		X	Accept
2 or More Major Rejects]		X		100% Inspect & Repair Modules made to this time-take corrective action.
1 or More Minor Rejects			NOTIFY FOREMAN TO	TAKE CORRECTIVE ACTION
Resample - 1 Module (b) 0 Major Rejects	X			Accept
1 or More Major Rejects		X		100% Inspect & Repair Modules made to this time-take corrective action.
1 or More Minor Rejects Repeat on 2nd thru Final Sample			NOTIFY FOREMAN TO	TAKE CORRECTIVE ACTION
Pull Test - 3 Grams All Wires      1.0 mil wires 3.0 Grams      0.7 mil wires 1.5 Grams				
1st Sample (a) 0 Rejects 3 Grams 1 Reject 3 Grams	X		X	Accept
2 or More Reject 3 Grams		X		100% Pull Test (type of wire failed) to 2 Grams (for 1 mil wires and 1 Gram for 0.7 mil wires) & Repair Modules made to this time-take corrective action.
Resample - 1 Module (b) 0 Rejects 3 Grams 1 or More Rejects 3 Grams	X			Accept
		X		100% Pull Test (type of wire failed) to 2 Grams (for 1 mil wires and 1 Gram for 0.7 mil wires) & Repair Modules made to this time - take corrective action.
2nd thru Final Sample      IF NO FAILURES HAVE OCCURRED - SAME AS 1st SAMPLE				
2nd thru Final Sample 0 Rejects 3 Grams 1 or More Rejects 3 Grams	X			Accept
		X		100% Pull Test (type of wire failed) to 2 Grams (for 1 mil wires and 1 Gram for 0.7 mil wires) & Repair Modules made to this time - take corrective action

APPENDIX A

H60600 thru H60607

SAMPLE SIZE - 2 MODULE PER LOT OR 2 PER SHIFT WHICHEVER IS GREATER

VISUAL INSPECTION	ACCEPT	STOP	RESAMPLE	LOT DISPOSITION
1st Sample				
(a) 0 Major Rejects	X			Accept
1 Major Reject			X	
2 or More Major Rejects		X		100% Inspect & Repair Modules made to this time-take corrective action.
1 or More Minor Rejects				NOTIFY FOREMAN TO TAKE CORRECTIVE ACTION
Resample - 1 Module				
(b) 0 Major Rejects	X			Accept
1 or More Major Rejects		X		100% Inspect & Repair Modules made to this time-take corrective action.
1 or More Minor Rejects				NOTIFY FOREMAN TO TAKE CORRECTIVE ACTION
Repeat on 2nd thru Final Sample				
Pull Test - 3 Grams All Wires				
1st Sample				
(a) 0 Rejects 3 Grams	X			Accept
1 Reject 3 Grams			X	
2 or More Rejects 3 Grams		X		100% Pull Test to 2 Grams & Repair Modules made to this time-take corrective action.
Resample - 1 Module				
(b) 0 Rejects 3 Grams	X			Accept
1 or more Rejects 3 Grams		X		100% Pull Test to 2 Grams & Repair Module made to this time-take corrective action.
2nd thru Final Sample				IF NO FAILURES HAVE OCCURRED - SAME AS 1st SAMPLE
2nd thru Final Sample				IF 1 REJECT WAS PREVIOUSLY FOUND:
0 Rejects 3 Grams	X			Accept
1 or More Rejects 3 Grams		X		100% Pull Test to 2 Grams & Repair Module made to this time-take corrective action.

H60278A

SAMPLE SIZE - 2 MODULE PER LOT OR 2 PER SHIFT WHICHEVER IS GREATER

VISUAL INSPECTION	ACCEPT	STOP	RESAMPLE	LOT DISPOSITION
1st Sample				
(a) 0 Major Rejects	X			Accept
1 Major Reject			X	
2 or More Major Rejects		X		100% Inspect & Repair Modules made to this time-take corrective action.
1 or More Minor Rejects				NOTIFY FOREMAN TO TAKE CORRECTIVE ACTION
Resample - 1 Module				
(b) 0 Major Rejects	X			Accept
1 or More Major Rejects		X		100% Inspect & Repair Modules made to this time-take corrective action.
1 or More Minor Rejects				NOTIFY FOREMAN TO TAKE CORRECTIVE ACTION
Repeat on 2nd thru Final Sample				
Pull Test - 3 Grams All Wires				
1st Sample				
(a) 0 Rejects 3 Grams	X			Accept
1 Reject 3 Grams			X	
2 or More Rejects 3 Grams		X		100% Pull Test to 2 Grams & Repair Modules made to this time-take corrective action.
Resample - 1 Module				
(b) 0 Rejects 3 Grams	X			Accept
1 or More Rejects 3 Grams		X		100% Pull Test to 2 Grams & Repair Module made to this time-take corrective action.
2nd thru Final Sample				IF NO FAILURES HAVE OCCURRED - SAME AS 1st SAMPLE
2nd thru Final Sample				FOUND:
0 Rejects 3 Grams	X			Accept
1 or More Rejects 3 Grams		X		100% Pull Test to 2 Grams & Repair Module made to this time-take corrective action.

SAMPLE SIZE - 2 MODULE PER LOT OR 2 PER SHIFT WHICHEVER IS GREATER

VISUAL INSPECTION	ACCEPT	STOP	RESAMPLE	LOT DISPOSITION
1st Sample				
(a) 0 Major Rejects	X			Accept
1 Major Reject			X	
2 or More Major Rejects		X		100% Inspect & Repair Modules made to this time-take corrective action.
1 or More Minor Rejects				NOTIFY FOREMAN TO TAKE CORRECTIVE ACTION
Resample - 1 Module				
(b) 0 Major Rejects	X			Accept
1 or More Major Rejects		X		100% Inspect & Repair Modules made to this time-take corrective action.
1 or More Minor Rejects				NOTIFY FOREMAN TO TAKE CORRECTIVE ACTION
Repeat on 2nd thru final sample				
Pull Test- 7.5 Grams All Wires				
1st Sample				
(a) 0 Rejects 7.5 Grams	X			Accept
1 Reject 7.5 Grams			X	
2 or More Rejects 7.5 Grams		X		100% Pull Test to 5 Grams & Repair Modules made to this time-take corrective action.
Resample - 1 Module				
(b) 0 Rejects 7.5 Grams	X			Accept
1 or more Rejects 7.5 Grams		X		100% Pull Test to 5 Grams & Repair Module made to this time-take corrective action.
2nd thru Final Sample				IF NO FAILURES HAVE OCCURRED - SAME AS 1st SAMPLE
2nd thru Final Sample				IF 1 REJECT WAS PREVIOUSLY FOUND:
0 Rejects 7.5 Grams	X			Accept
1 or More Rejects 7.5 Grams		X		100% Pull Test to 5 Grams & Repair Module made to this time-take corrective action.

NOTE: Pull only one bond in each pair or group of four.

H60235-6-7, H60405-6, H60372-3-4-5-8-9

APPENDIX 12

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Feb.13, 1979

## PATRIOT; MAGNAVOX - IN- PROCESS

SAMPLE SIZE - 5 MODULES PER LOT OR 2 PER SHIFT WHICHEVER IS GREATER, LOTS  $\geq$  50 pcs.  
 SAMPLE SIZE - 2 MODULES PER LOT OR 2 PER SHIFT WHICHEVER IS GREATER, LOTS  $<$  50 pcs.

VISUAL INSPECTION	ACCEPT	STOP	RESAMPLE	LOT DISPOSITION
1st Sample				
(a) 0 Major Reject	X			Accept
1 Major Reject			X	
2 or more Major Rejects		X		100% Inspect & Repair Modules made to this time-take corrective action
1 or More Minor Rejects				NOTIFY FOREMAN TO TAKE CORRECTION ACTION
Resample - 1 Module				
(b) 0 Major Reject	X			Accept
1 or More Major Rejects		X		100% Inspect & Repair Modules made to this time-take corrective action.
1 or More Minor Rejects				
Repeat for 2nd - 5th Sample				NOTIFY FOREMAN TO TAKE CORRECTIVE ACTION
Pull Test - 6 Grams - All Wires			Wire 0.002" Gold	
1st Sample				
(a) 0 Rejects 6 Grams	X			Accept
1 Reject 6 Grams			X	
2 Rejects or More 6 Grams		X		100% Pull Test to 5 Grams & Repair Modules made to this time-take corrective action
Resample - 2 Modules				
(b) 0 Rejects 6 Grams	X			Accept
1 or More Rejects 6 Grams		X		100% Pull Test to 5 Grams & Repair Modules made to this time-take corrective action
2nd thru 5th Sample				IF NO FAILURES HAVE OCCURRED - SAME AS 1ST SAMPLE
2nd thru 5th Sample				IF 1 REJECT WAS PREVIOUSLY FOUND:
0 Rejects 6 Grams	X			Accept
1 or More Rejects 6 Grams		X		100% Pull Test to 5 Grams & Repair Modules make to this time-take corrective action



RAYTHEON COMPANY

Form 20-0044

APPENDIX 13		Operation Standard 1253	
		Sheet 15	Rev. 0
		Date June 28, 1978	
Subject	INPROCESS BONDING MACHINE/OPERATOR CONTROL		POC 78-6377

## APPENDIX 13: INPROCESS - BONDING MACHINE/OPERATOR CONTROL

Each bonding machine/operator shall be evaluated at the start of every 4-hour shift or when put into operation during each 4-hour shift period and whenever a change is made in material (i.e., new spool of wire or change in wire size), machine parts (i.e., capillary tip, etc.) or machine adjustments (stage temperature, pressure, etc.,). A minimum of 10 wires consisting of chip (microcircuit and semiconductor) to substrate bonds shall be subjected to destructive pull test and shall meet, as a minimum, the criteria of MIL-STD-883, Method 2011 Table 1. Testing may be performed on simulated or actual test vehicles. A bonding machine/operator not meeting the evaluated requirements shall not be used. Records shall also indicate the action taken when each out-of-control condition is observed, and the disposition of the microcircuits processed during the period of out-of-control operation. The wire bonder shall be inactivated immediately and shall not be returned to production until tests show that satisfactory operation has been established. All microcircuits wire-bonded since the last satisfactory test shall be subject to disposition of an Internal Material Review.



# RAYTHEON COMPANY

		Operation Standard 1253	
		Sheet 16	Rev. 0
APPENDIX 14		Date June 28, 1978	
Subject	LOT SAMPLE BOND STRENGTH TEST	POC 78-6377	

## APPENDIX 14: LOT SAMPLE BOND STRENGTH TEST

A nondestructive wire bond strength test shall be performed on every bonding run of hybrid microcircuits. As a minimum, two randomly selected microcircuits from any bonding run (defined as any number of hybrid circuit of the same part number that are bonded consecutively by one machine/operator, not to exceed 4 hours) shall be subjected to a nondestructive bond pull test equal to one half the minimum bond strength specified for the pre-seal level in MIL-STD-883, Method 2011 Table 1. The number of wires pulled in each sample part shall, as a minimum, be one wire from each type of the transistor, diode, capacitor, and resistor chips, three wires from each type of integrated circuit, and five wires from header to substrate, as applicable. In no case shall the total number of wires pulled be less than 15. The bonding run shall be acceptable if no failure occurred. If one wire/bond fails another sample shall be selected and subjected to a one hundred percent non-destructive wire bond strength test. If the second sample contains no failures the bonding run is acceptable. If the second sample also contains wire/bond failure(s), the bonding machine/operator shall be removed from operation. The failures shall be investigated and appropriate corrective action shall be implemented. The machine/operator shall be re-certified in accordance with Appendix 13 before being returned to operation. All hybrid microcircuits bonded since the previous certification shall be subjected to one hundred percent non-destructive bond strength test at 1/2 the pre-seal limit specified in MIL-STD-883B method 2011.

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PG. 17 REV 0  
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12/27/78

APPENDIX 15

PROGRAM: FORD AEROSPACE - SHILLELAGH  
TYPES: H60478 TO H60482  
LOT SIZE: 5 SAMPLE SIZE: 1st Module at Start. Hold Manufacture of Lot until Approval

	ACCEPT	STOP	RESAMPLE	DISPOSITION
1. <u>VISUAL INSPECTION</u>				
a) 1st Sample				
0 Major Reject	X			
1 Major Reject			X	
2 or More Major Rej.		X		100% Inspect remainder of lot - Take corrective action. Notify Production Supervisor to take corrective action.
1 or More Minor Rej.				
b) Resample				
0 Major Reject	X			
1 or More Major Rej.		X		100% inspect remainder of lot - Take corrective action Notify Production Supervisor to take corrective action
1 or More Minor Rej.				
2. <u>PULL TEST</u>				
a) 1st Sample				This procedure will accomplish both lot approval and in process machine/operator inspection.  Inspect unit of 1 a) above. 3.0 gram pull (.001" Au - Thermosonic) 25 wires: Select at least one wire per chip and 2 posts.  Bond a second unit for resampling pull test.
0 Rejects				
1 Rejects	X		X	
b) Resample				
0 Rejects	X			
1 Rejects		X		IMR. Do not manufacture further until cause for rejection has been determined and corrected.



# APPENDIX 16

0.S. 1253 REV 0  
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SAMPLE SIZE - 5 MODULES PER LOT OR 2 PER SHIFT WHICHEVER IS GREATER  $\geq$  50 pcs.  
SAMPLE SIZE - 2 MODULES PER LOT OR 2 PER SHIFT WHICHEVER IS GREATER  $<$  50 pcs.

INSPECTION	ACCEPT	STOP	RESAMPLE	LOT DISPOSITION
1st Sample				
0 Major Rejects	X			Accept
1 Major Reject			X	
2 or More Major Rejects		X		100% Inspect & Repair Modules made to this time - take corrective action.
1 or More Minor Rejects	NOTIFY FOREMAN TO TAKE CORRECTIVE ACTION			
Resample - 1 Module (b) 0 Major Rejects	X			Accept
1 or More Major Rejects		X		100% Inspect & Repair Modules make to this time - take corrective action.
1 or More Minor Rejects	NO IF FOREMAN TO TAKE CORRECTIVE ACTION			
Repeat on 2nd thru Final Sample				
Pull Test - 6 Grams All Wires			2.0 Mil Wire - Gold	
1st Sample				Accept
(a) 0 Rejects 6 Grams	X			
1 Reject 6 Grams			X	
2 or More Rejects 6 Grams		X		100% Pull Test to 5 grams & repair modules made to this time. Take corrective action.
Resample - 1 Module (b) 0 Rejects 6 Grams	X			Accept
1 or More Rejects 6 Grams		X		100% Pull Test to 5 grams & repair modules made to this time. Take corrective action.
2nd thru Final Sample	IF NO FAILURES HAVE OCCURRED - SAME AS 1st SAMPLE			
2nd thru Final Sample 0 Rejects 6 Grams	X			IF 1 REJECT WAS PREVIOUSLY FOUND: Accept
1 or More Rejects 6 Grams		X		100% Pull Test to 5 grams & repair modules made to this time. Take corrective action.

PROGRAM: SPARROW AMS  
TYPES: H60366, H60367

APPENDIX 17

O.S. 1253 REV 0  
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SAMPLE SIZE - 5 MODULES PER LOT OR 2 PER SHIFT WHICHEVER IS GREATER 50 PCS.  
SAMPLE SIZE - 2 MODULES PER LOT OR 2 PER SHIFT WHICHEVER IS GREATER 50 PCS.

VISUAL INSPECTION	ACCEPT	STOP	RESAMPLE	LOT DISPOSITION
1st Sample (a) 0 Major Rejects	X			Accept
1 Major Reject			X	
2 or More Major Rejects		X		100% Inspect & Repair Modules made to this time- take corrective action.
1 or More Minor Rejects	NOTIFY FOREMAN TO TAKE CORRECTIVE ACTION			
Resample - 1 Module (b) 0 Major Rejects	X			Accept
1 or More Major Rejects		X		100% Inspect & Repair Modules made to this time- take corrective action.
1 or More Minor Rejects	NOTIFY FOREMAN TO TAKE CORRECTIVE ACTION			
Repeat on 2nd thru Final Sample				
Pull Test - 3 Grams All Wires				
1st Sample (a) 0 Rejects 3 Grams	X			Accept
1 Reject 3 Grams			X	
2 or More Rejects 3 Grams		X		100% Pull Test to 2 Grams & repair modules made to this time- take corrective action.
Resample - 1 Module (b) 0 Rejects 3 Grams	X			Accept
1 or More Rejects 3 Grams		X		100% Pull Test to 2 Grams & repair modules made to this time- take corrective action.
2nd thru Final Sample	IF NO FAILURES HAVE OCCURRED - SAME AS 1st SAMPLE			
2nd thru Final Sample 0 Rejects 3 Grams	X			Accept
1 or More Rejects 3 Grams		X		100% Pull Test to 2 Grams & repair modules made to this time- take corrective action.

PROGRAM: ECOM TCVCX0  
TYPE: H60388-1

APPENDIX 18

O.S. 1253 REV 0  
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SAMPLE SIZE - 5 MODULES PER LOT OR 2 PER SHIFT WHICHEVER IS GREATER 50 PCS.  
SAMPLE SIZE - 2 MODULES PER LOT OR 2 PER SHIFT WHICHEVER IS GREATER 50 PCS.

VISUAL INSPECTION	ACCEPT	STOP	RESAMPLE	LOT DISPOSITION
1st Sample (a) 0 Major Rejects	X			Accept
1 Major Rejects			X	
2 or More Rejects		X		100% Inspect & Repair Modules made to this time-take corrective action.
1 or More Minor Rejects NOTIFY FOREMAN TO TAKE CORRECTIVE ACTION				
Resample - 1 Module (b) 0 Major Rejects	X			Accept
1 or More Major Rejects		X		100% Inspect & Repair Modules made to this time-take corrective action.
1 or More Minor Rejects NOTIFY FOREMAN TO TAKE CORRECTIVE ACTION				
Repeat on 2nd thru Final Sample				
Pull Test - 3 Grams All Wires 1 Mil. Gold Wire Except Q1 & Q3*				
1st Sample (a) 0 Rejects 3 Grams	X			Accept
1 Reject 3 Grams			X	
2 or More Rejects 3 Grams		X		100% Pull Test to 2 Grams & repair modules made to this time-take corrective action.
Resample - 1 Module (b) 0 Rejects 3 Grams	X			Accept
1 or More Rejects 3 Grams		X		100% Pull Test to 2 Grams & repair modules made to this time-take corrective action.
2nd thru Final Sample IF NO FAILURES HAVE OCCURRED - SAME AS 1st SAMPLE				
2nd thru Final Sample 0 Rejects 3 Grams	X			Accept
1 or More Rejects 3 Grams		X		100% Pull Test to 2 Grams & repair modules made to this time-take corrective action.

\*Q1 & Q3 Test at 2 Grams



RAYTHEON COMPANY

Operation Standard 1255	
Sheet 21	Rev. 0
Date November 27, 1979	
POC 79-6907	

Subject
APPENDIX 19, HCHM - BEDFORD

A. VISUAL INSPECTION:

1. Inspect every module per O.S. 1594.
  - IC's diodes, transistors at 100X
  - All other features at 60X
2. Itemize all repairable defects on rework sheet by serial number.
3. Examine:
  - Lot Traveler for proper entries
  - Rework sheet attached with proper entries
  - Copies of all inspection records

B. PULL TEST:


1. Machine/Operator - Destruct Pull Test (See Appendix 13)
  - a. Every 4 hours
  - b. Use similar type or reject substrate assembly with equivalent chips. Wire bond 10 wires - substrate to chip
  - c. Bond strength - 2.5 grams min. (.001 Aluminum Wire)
    - Pull test to destruction
    - 0 failures - accept lot
    - 1 failure - stop. Issue IMR
    - Hold lots prior to failure for disposition
  - d. Maintain record sheet of results above.
2. Bond Strength - 1.5 grams (In Process Pull Test)
  - a. Sample size: 2 units/lot/shift
  - b. Quantity: Pull test 15 wires min.
    - 1 wire from each diode, transistor, resistor, capacitor.
    - 3 wires from post to substrate
    - 5 wires from each IC

c. Acceptance Criteria:

- 2 samples - 0 failures accept lot

Rejection Criteria:

- 1st sample - 1 failure 100% pull test this unit
- 2nd sample - 0 failures accept lot
  - 1 failure Write IMR

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		<b>Sheet</b> 1	<b>Rev.</b> 28
		<b>Date</b> April 5, 1980	
<b>Subject</b> LOT ACCEPTANCE INSPECTION FOR SCREENED AND TRIMMED SUBSTRATES		POC 80-4359	

#### 1.0 SCOPE:

This procedure details the Inspections to be performed upon all thick film screened substrates.

#### 2.0 APPLICABLE DOCUMENTS:

- 2.1 O.S. 1007
- 2.2 O.S. 1008
- 2.3 O.S. 1009
- 2.4 O.S. 1010
- 2.5 O.S. 1018
- 2.6 O.S. 1022
- 2.7 O.S. 1128
- 2.8 Deleted per POC 70-6039
- 2.9 " " "
- 2.10 O.S. MIL-STD-105D

#### 3.0 EQUIPMENT:

- 3.1 Microscope 10-60X Top light and backlight capability.
- 3.2 Eyepiece with .001 micrometer disc
- 3.3 Grounding wrist strap
- 3.4 Digital voltmeter - HP 3440 or equivalent
- 3.5 Multi-function plug-in HP 3444
- 3.6 Comparator 20X nikon - V-16 or equivalent
- 3.7 Stereo microscope 10-70X Toplight capability

#### NOTICE:

In the event of any omissions, conflicts, ambiguities, or inconsistencies involving this document and detail specification, the detail specification shall prevail.

#### 4.0 QUALITY IN-PROCESS CHECK - SCREENING OPERATION:

On all ARCO product using dielectric insulation layer, perform a 5 piece QC random sample for porosity dye test (OS 1622) immediately after final firing of the dielectric layer. Reject the lot if the sample fails the test.

1	2	2A	3	3A	4	4A	5	6	7	8	9	10	11						
28	9	0	18	18	15	1	3	0	0	0	2	0	0						



RAYTHEON COMPANY

Form 20-0044

		Operation Standard 1261	
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		Date Feb. 13, 1980	
		POC 80-4145	
Subject		LOT ACCEPTANCE INSPECTION FOR SCREENED AND TRIMMED SUBSTRATES	

5.0 Deleted

6.0 LOT ACCEPTANCE - PRE-TRIM:

- 6.1 Upon completion of the 24 hour resistor bake prior to conductor soldering and/or resistor trimming the entire lot shall be submitted to Quality Control.
- 6.2 The quality inspector shall draw 25 units at random. For ARCO, take a 76 pc random sample.
- 6.3 The sample shall be examined for those items listed in O.S. 1265 at 10X magnification. Substrates exhibiting one or more defects shall be considered reject units. Samples failing to meet the accept numbers of Para. 9.2.2 shall be cause for lot rejections.
- 6.4 The quality inspector shall draw 7 substrates from the original sample and measure and record the resistor values of these units.
- 6.5 The resistor values shall conform to the specified Post Fire limits. Two discrepant readings shall reject the lot. Also the median must fall within 10-90% of limits.

7.0 POST MODULE DYNAMIC ADJUST:

The sample shall be defined for each program and shall be inspected for those defects listed in O.S. 1265 at 10X to 60X magnification. For items where backlighting is not possible, toplight inspection with the stereo microscope up to 70X may be used. For all static sensitive programs, the inspector must be grounded using a wrist strap or other suitable means when handling these modules.

<u>PROGRAM</u>	<u>SAMPLE SIZE</u>	<u>STATIC SENSITIVE</u>
ARCO APP	100%	YES
AMS	100%	NO
H60366	15 pcs.	NO
H60367	15 pcs.	NO
H60467	15 pcs.	NO
H60468	15 pcs.	NO
H60469	15 pcs.	NO
H60470	15 pcs.	NO



RAYTHEON COMPANY

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80-4145	

Subject LOT ACCEPTANCE INSPECTION FOR SCREENED  
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7.0 POST MODULE DYNAMIC ADJUST: (cont'd)

<u>PROGRAM</u>	<u>SAMPLE SIZE</u>	<u>STATIC SENSITIVE</u>
AMRAAM	15 pcs.	NO
H60454	15 pcs.	NO
H60455	15 pcs.	NO
H60457	15 pcs.	NO
H60490	15 pcs.	NO
H60491	15 pcs.	NO
H60492	15 pcs.	NO
H60493	15 pcs.	NO
H60494	15 pcs.	NO
H60495	15 pcs.	NO
H 60496	15 pcs.	NO

8.0 Deleted per POC 70-6039

9.0 FINAL LOT ACCEPTANCE: (see Para. 13.0)

9.1 All lots of finished substrates shall be submitted to Quality Control.



Form 20--0044

## RAYTHEON COMPANY

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	POC 79-6166		
LOT ACCEPTANCE INSPECTION FOR SCREENED AND TRIMMED SUBSTRATES			

9.0 FINAL LOT ACCEPTANCE: Cont.

## 9.2 Visual Examination (10X-60X magnification)

9.2.1 The Quality Inspector shall draw, at random, 25 units.

9.2.2 The sample shall be examined for those defects listed in O.S.1265 at 10X to 60X magnification. Each substrate with one or more defects shall be considered a reject unit. Lots failing to meet the Accept Criteria of Para. 9.2.2.1 shall be rejected.

## 9.2.2.1

Acceptance Number Chart

	<u>Ind. Item</u>	<u>Cumulative</u>
Min. Defects	3	10
Major	0	0

9.3 Resistor Values:

9.3.1 The Quality Inspector shall check 25 pieces for resistor value.

9.3.2 The resistor values of each resistor on the substrate shall be measured.

9.3.3 Record the resistance values of the first five substrates and all discrepant readings noted in the remainder of the sample. Subject the first 5 substrates to heat soak at  $+150^{\circ}\pm 10^{\circ}\text{C}$  in air for a minimum of 48 hrs. Read and record all resistors. Calculate R and reject if 1 or more resistors exceed  $\pm 0.5\%$  or if resistors exceed minimum or maximum limits.

NOTE: For H60171A resistors R8 and R9 reject only to minimum or maximum limits criteria.

9.3.4 Substrates with one or more resistors which fail to meet the specified resistance limits shall be considered a reject unit.

9.3.5 Use Accept/Defect number of para. 9.2.2 out of tolerance resistors are a major defect. For purposes of this inspection, out of tolerance resistors, whether high or low, shall be considered as one type of defective.

Draw a sample of 10 substrates and check all dimensions that apply to corrals on the applicable blueprint. No rejects allowed.





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9.0 FINAL LOT ACCEPTANCE: CONT.9.5 Conductor Adhesion Test - Solder Programs:

Two trim scrap substrates from each lot will be delivered to the Production Assembly Foreman (Solder Programs) by Q.C. Inspector. He will have the substrates soldered and wired as described below and return them to the Q.C. Inspector. The Q.C. Inspector will then evaluate the substrates as described below.

Production Soldering and Wiring:

Not later than 1 hour prior to soldering, erase the pads 20-25 times to be soldered with an ink eraser #853 or equivalent and then air clean the pads.

Hand solder conductor pads to be wired per requirements below in this paragraph or flow solder conductor lands on chip and wire types per O.S.1015. Solder 4 number 26 tinned copper wires to conductor pads of each substrate. (See Figure 1). Use same size conductor pads where possible. Do not use exit lead pads on G.P.L. substrates. Use a maximum amount of 60/40 QQS-571 solder, Kester 1571 flux, 12 watt pretinned iron at 245° to 270°C and a hot plate at 125°C to 128°C. After soldering clean the substrates in the ultrasonic generator with TMC Freon for 2 minutes.

Evaluation:


Subject the substrates to 30 temperature cycles per MIL-STD-883B Method 1010.2 condition C (-55°C to +125°C) the exposure time at high and low temperature will be 30 minutes. Perform and record 90°C Peel Test on each joint (8 readings). Number each pad location on the substrate to agree with the number of the force reading (lbs.). Record the size of each pulled pad using the microscope and reticle. Divide the force reading by the area of the pad to calculate the pound per square inch reading. (PSI)\*. Minimum peel strength is specified below\*\*. No rejects allowed after temperature cycle.

Sparrow - 360 PSI  
G.P.L. - 600 PSI\*\*  
R. C. A. - 600 PSI

C.D.C. - 600\*\*(See Note)  
Arco - 600\*\*

NOTE: (CDC AND RCA ONLY)

If wires, during pull test, are pulled free from the solder pads and solder and substrate metallization are intact, then accept the sample. Do not reject.

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9.0 FINAL LOT ACCEPTANCE: (cont.)

9.6 Conductor Adhesion Test - Chip and Wire Programs:

Deliver 2 scrap substrates from each screening lot to the Chip and Wire Assembly area. Take 2 P/N 26380 diode chips (or equivalent) and process through a standard die attach and wire bond sequence (do not use preforms). Give the sample to the Q.C. Inspector. Parts will be tested as follows:

- A. Pull test wire to 3 grams min. for 1 mil. gold wire and 6 grams min. for 2 mil gold wire. Record any rejects.
- B. Push test chip to 100 grams. Reject if chip shears cleanly from the conductor or removes the gold from the substrate.



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POC 74 6297	

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SCREENED AND TRIMMED SUBSTRATES

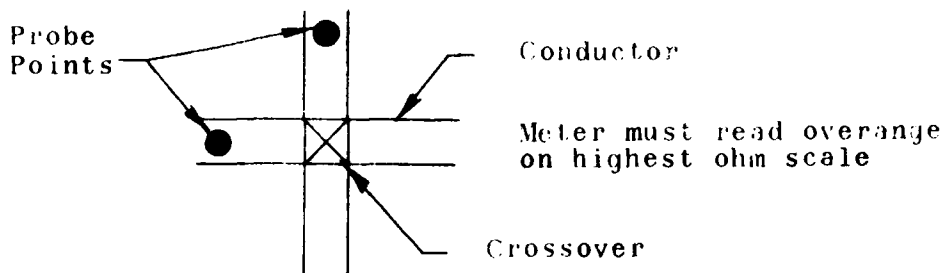
#### 9.0 FINAL LOT ACCEPTANCE: Cont.

\* Or use appropriate chart of Appendix A.

\*\* Median of all readings must exceed 300 PSI.

9.7 Shorts & Opens Test - Multi layer substrates. Take a 10 piece sample and test per table on applicable layout drawing. No rejects allowed.

9.8 Short Test - Crossovers - On all types that have crossovers take a 10 piece sample and check all crossovers on each sample as shown below. No rejects allowed.



#### 9.9 Helium Leak Test (Unsealed - After Corral Attach)

The Quality Inspector shall draw a random sample from each substrate lot and helium leak test per O.S. 1394. The sample size and accept/reject criteria shall be as specified below:

Table - Helium Leak Test Sample

Lot Size	Sample Size	* Rejects	Disposition
Up to 200 Pcs	25 Pcs	0	Accept Lot
		1 or more	Reject Lot
201 Pcs or More	50 Pcs.	0	Accept Lot
		1	Re-sample 50 more pieces
			- Accept if 0 additional rejects
			- Reject if 1 or more add. "
		2 or more	Reject lot



RAYTHEON COMPANY

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	°PC 77-6019	

## 9.0 FINAL LOT ACCEPTANCE: Cont.

- 9.9 Beam Lead Pad Registration - Table a 2 piece sample and using the beam lead template check registration at each chip site. The template must be positioned so that conductor pad is visible under the outlin of each beam.
- 9.10 Read & Record resistor noise on resistors R15 & R16 on substrate 28676 (GPL) with input voltages 28db & 40db respectively. Test 5 substrates and allow zero rejects. The noise limits are +16db for R15 and +10db for R16.

## 10.0 RESUBMITTED LOTS:

- 10.3 The sample shall be inspected using the acceptance criteria of O.S. 1265. Inspection shall be limited to the particular type of defect which caused the initial rejection.

Note 1: Random samples should be taken by selecting one substrate at a time, approximately every "X" pieces. The number "X" should be the lot size divided by the sample size. (e.g., for a lot size of 450 and a sample of 25, then  $450/25 = 18$ . Thus, each sample piece should be drawn approximately every 18 pieces on the tray).

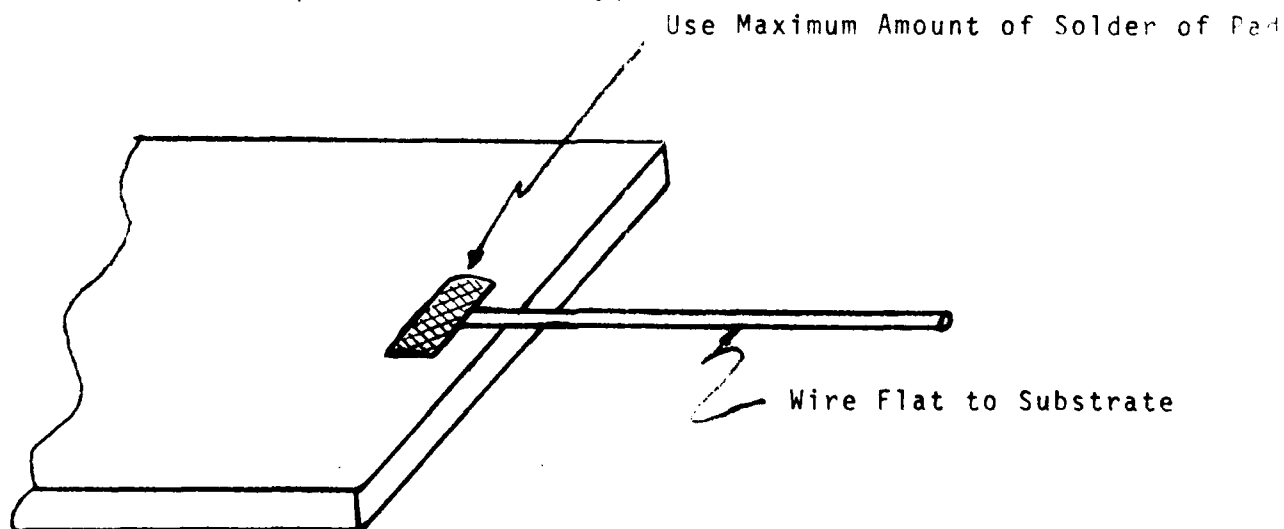



Figure 1  
Soldering Wire To Substrate

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		Sheet 6	Rev. 0
Subject LOT ACCEPTANCE INSPECTION FOR SCREENED AND TRIMMED SUBSTRATES		Date May 27, 1977	
		POC 77-6212	

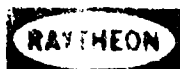
# 11.0 Acceptance Test for Arco Substrates

- 11.1 Maximum lot size to be 1000 pcs.
- 11.2 Test type - 10 day Humidity with bias
- 11.3 Sample Size - 20 tinned, cleaned and dried substrates
- 11.4 Allowable failures - 0 if short is at crossover  
1 if short is on surface
- 11.5 Conditions of Test:

Duration - 10 days  
Bias - 3.65 volts  $\pm$ .05V  
Temperature - 65°C  $\pm$ 5°C  
Humidity - 90% RH  $\pm$ 5% RH  
Frequency of reading - 24 hrs;  
 during weekends readings can be  
 extended to 48 to 72 hrs.  
Failure criteria: leakage in  
 excess of 10ua (100 millivolts  
 across resistor). Failed unit  
 is removed from chamber.  
Failure Confirmation: Air dry for  
 24 hrs before trying to confirm  
 failure. Any units which "recover"  
 or cannot be confirmed are re-  
 turned to chamber and the test units  
 are credited with a non failing  
 condition.

## 11.6 Test Method:

- 11.6.1 Select a minimum of 1 substrate from each fired tray of 25 pieces before these pieces are submitted for trimming but after they have completed all firing stages including top glaze.
- 11.6.2 Select at random 20 pieces from the above group for Humidity Test.



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## Test Method (Continued)

- 11.6.3 If the total sample size does not make up 20 pieces you may make up the total sample size by randomly selecting a second substrate from any of the trays. In no case shall more than two substrates be selected from any one tray.
- 11.6.4 These substrates are to be tinned, and wired, (as per the enclosed sketch) in accordance with the standard practice of the line at that time. This tinning and wiring will be done by production people on the line and will not be done in a selected area.
- 11.6.5 After wiring the units will be cleaned in accordance with the standard pre- pot module cleaning operation and in a production setting. No deviation in either cleaning or drying of these units from standard production techniques will be allowed.
- 11.6.6 After cleaning do not touch these substrates with your bare hands, handle the units by their wires.
- 11.6.7 If a repair of the test substrate is required it is allowable but this unit must then be recleaned in accordance with the cleaning sequence above.
- 11.6.8 After drying mount the wired units to a printed circuit test card in accordance with the enclosed sketch and submit them to the environmental lab for testing.
- 11.6.9 Do not allow the substrate lot to proceed beyond trimming until the humidity test has been completed.

12.0 Acceptance Test for Arco Substrates

## 12.1 Environmental Test Requirements:

Establish chamber and power supply to the limits called out above. Apply bias to the units in accordance to the wiring pattern in sketch No. II below. Apply the bias exactly the same at all times.

AD-A086 344

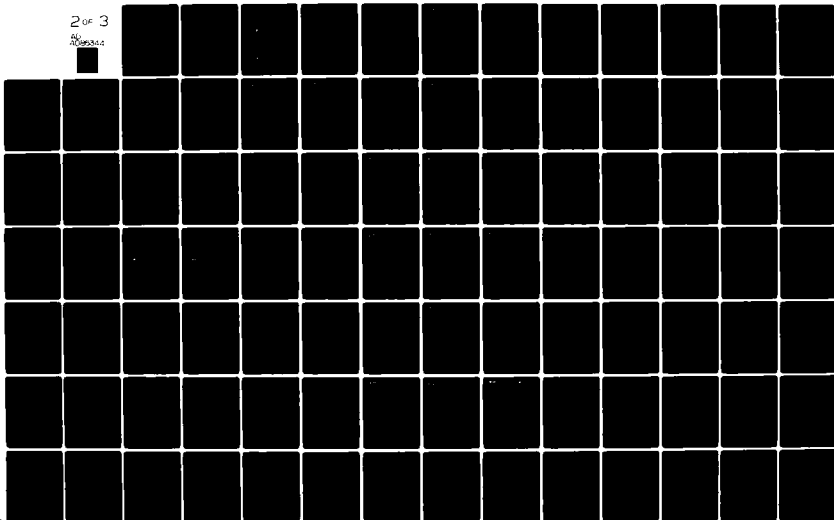
RAYTHEON CO QUINCY MASS INDUSTRIAL COMPONENTS OPERATION F/G 9/1  
MANUFACTURING METHODS AND TECHNOLOGY ENGINEERING (MM AND TE) PR--ETC(U)  
APR 80 R M ZILBERSTEIN DAAB07-76-C-8119

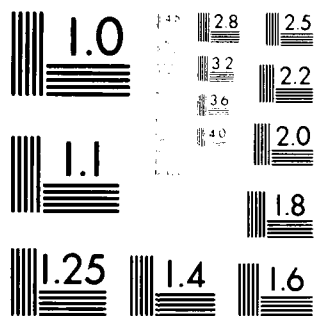
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DELET-TR-76-8119-F-VOL-2 NL

2 of 3

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MICROCOPY RESOLUTION TEST CHART  
NATIONAL BUREAU OF STANDARDS-1963-A





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	POC 77-6212	

## Environmental Test Requirements (continued)

- 12.2 Read every 24 hours  $\pm 1$  hour. Exception to this rule is granted during weekend operation as quoted above.
- 12.3 Avoid touching the units with your bare hands. Hang the units in the chamber, do not stack the units on top of one another. Make every effort to keep units from touching.
- 12.4 Units which show any leakage are to be noted in the log; however, a unit is not considered to have failed until it exhibits 120+ millivolts leakage.
- 12.5 Remove failed units from the test chamber and allow them to air dry for 24  $\pm 2$  hours before any confirmation testing is to be performed. During weekend operation when test confirmation cannot be performed within a 30 hour period, the failed units are to be left in the chamber until the time sequence is such that this analysis can be performed.
- 12.6 Deviation of the test confirmation will be allowed under special circumstances, in any case if confirmation cannot be obtained within (30) thirty hours return the suspect unit to the humidity chamber until such time as conditions allow control testing.
- 12.7 Q.C. Test Engineer:
- 12.7.1 Avoid any sudden application of power to these devices when trying to confirm the humidity test results.
- 12.7.2 Apply test prober through a resistive load so as not to burn out or fuze any probable short in the unit.
- 12.7.3 If the failure cannot be confirmed return the unit to the humidity chamber and continue the test as having no failure history.
- 12.7.4 If the failure is confirmed to a surface area (between conductors) two or more failures mandate one of the following:
- 12.7.5 Define whether the failure is caused by a cosmetic problem (eg) misalignment, scratched metalization etc. If this is the failure mode



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POC 77-6391	

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## Environmental Test Requirements (continued)

a 100% visual evaluation of the entire lot is to be carried out. The reject units are to be eliminated and a retest is to be performed on the residual of the lot.

12.7.6 If the defect is caused by surface contamination (eg) flux or fingerprints, remove the test pieces from the chamber, reclean in accordance with the cleaning conditions described above and resubmit the units to the test sequence, starting at the time when the failure occurred.

12.8 If the failure is confirmed to a cross over area, one failure rejects the lot and it is put on hold. A second submittal of samples will be allowed, if a subsequent failure occurs the total lot is rejected and scrapped. If no subsequent failures develop the lot is given a qualified release and carefully monitored throughout the line. Secondary failures in this lot will necessitate removal of the entire lot from the line.

13.0 Lot Packaging

Inspect each lot prior to delivery to stores. The entire lot must go into stores and remain in stores in covered containers.

14.0 PRE-inspection Step

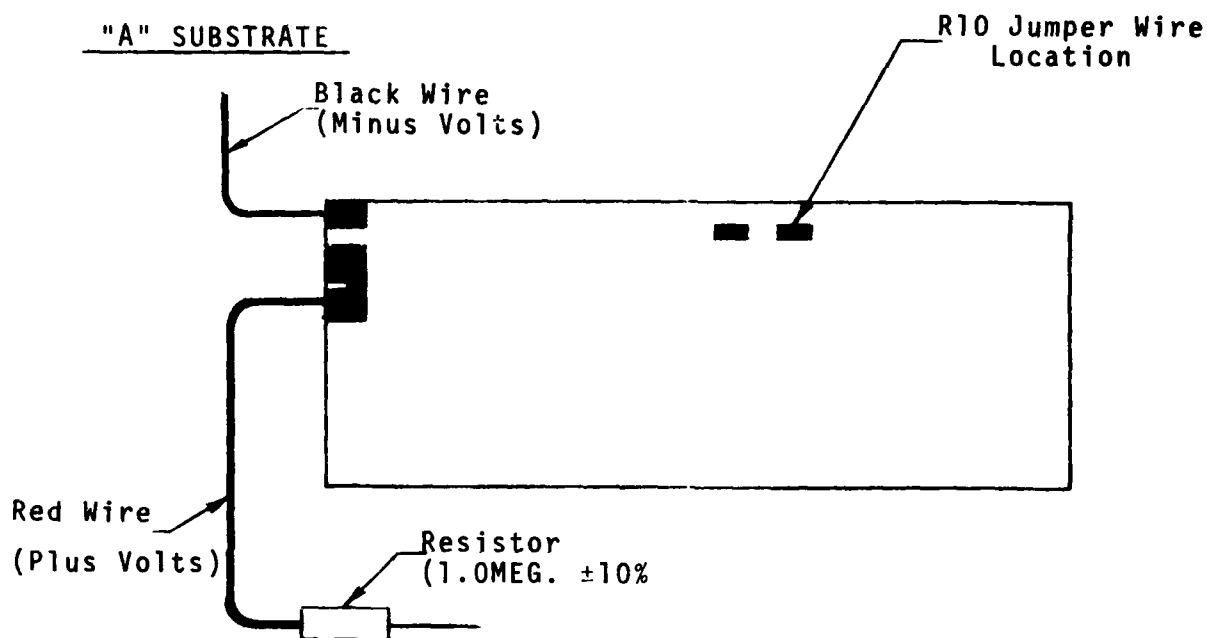
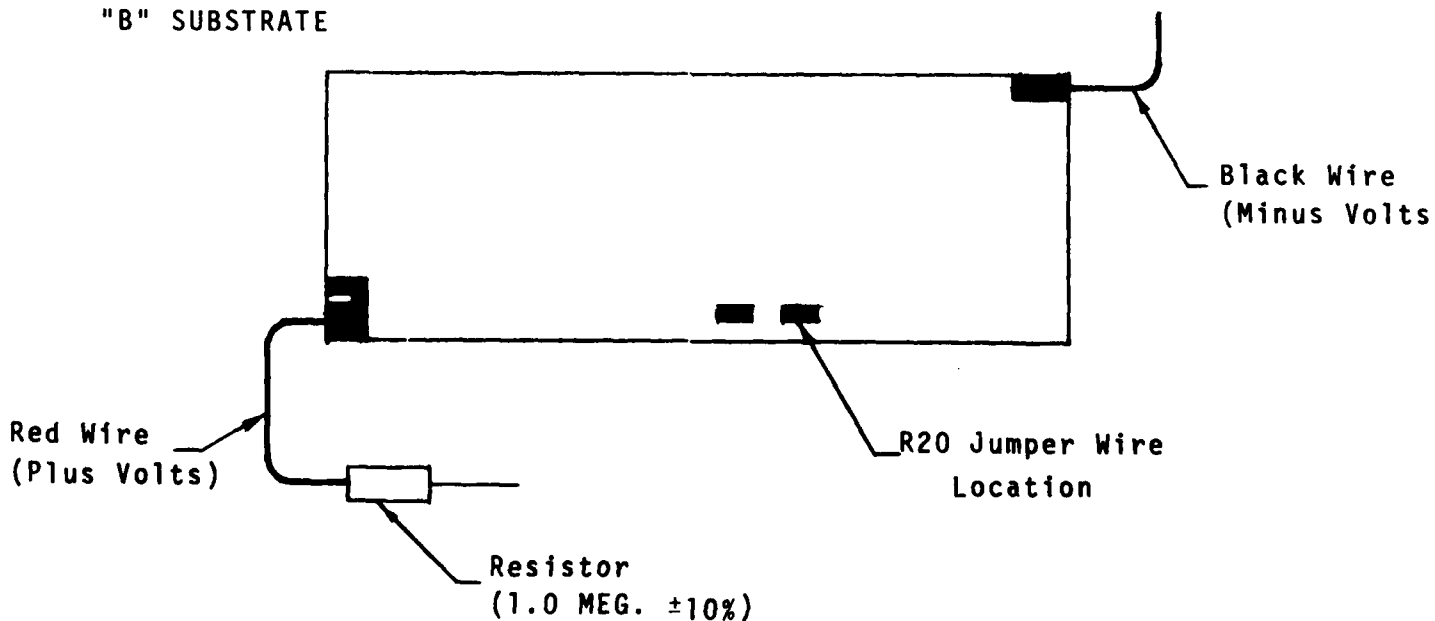
Check that all substrates are properly wired prior to submittal to Humidity Evaluation.



RAYTHEON COMPANY

Form 20-1041

Operation Standard	1261	
Sheet	10	Rev. 0
Date	May 27, 1977	
Subject	LOT ACCEPTANCE INSPECTION FOR SCREENED AND TRIMMED SUBSTRATES	
	POC 77-6212	

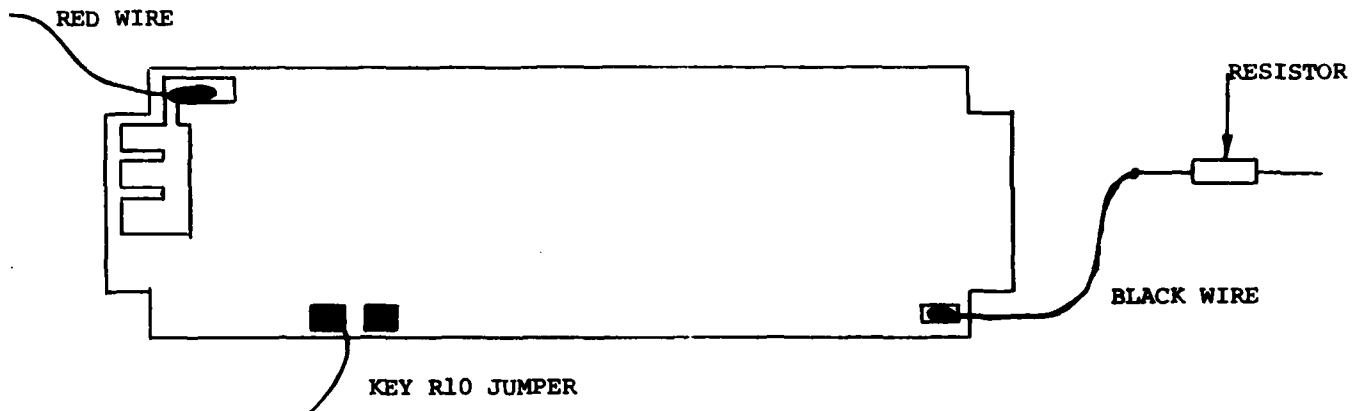
"A" SUBSTRATE"B" SUBSTRATE



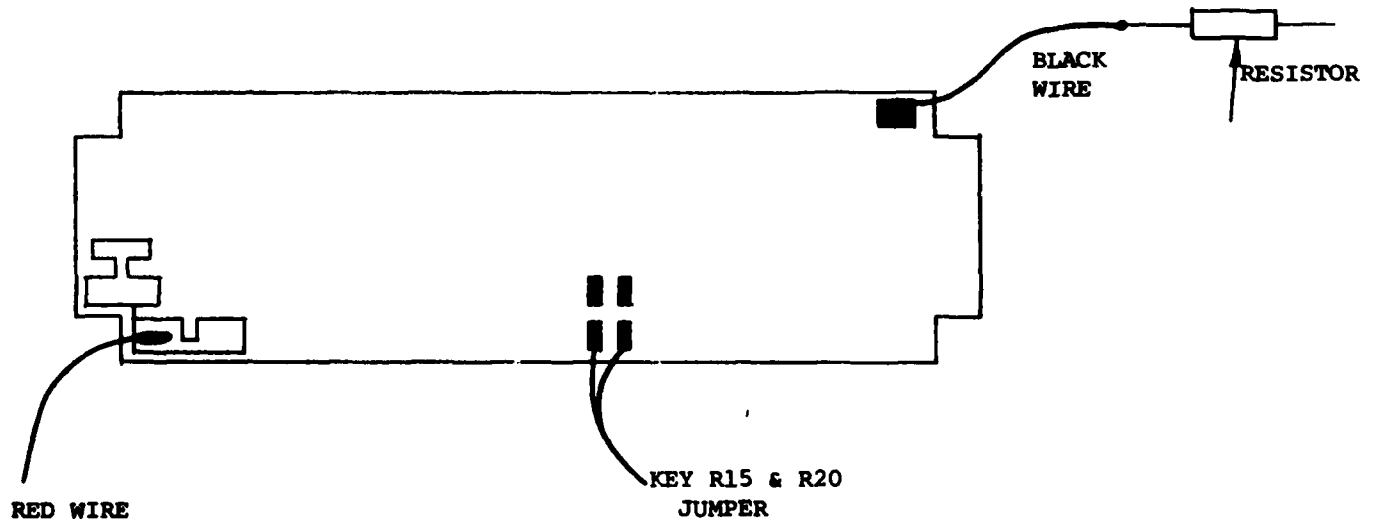
RAYTHEON COMPANY

Operation Standard	1261	
Sheet	11	Rev. 0
Date	October 12, 1977	
Subject	LOT ACCEPTANCE INSPECTION FOR SCREENED AND TRIMMED SUBSTRATES	
POC 77-6391		

H60504 "A"



H60504 "B"





RAYTHEON COMPANY

Operation Standard	1263	
Sheet	1	Rev. 11
Date	Dec. 20, 1978	
Subject	QUALITY INSPECTION OF DIE ATTACH OPERATION	
	POC 78-6696	

## 1.0 SCOPE:

This instruction details the inspection methods to be employed in performing In-Process Inspection of the Die Attach Operation.

## 2.0 APPLICABLE DOCUMENTS:

2.1 O.S. 1265

## 3.0 EQUIPMENT:

3.1 Microscope B+L Stereozoom with coaxial illuminator or equivalent.

## 4.0 LOT INSPECTION:

4.1 Upon completion of the die attach operation the entire lot shall be submitted to Quality Control for 100% visual inspection and sample tested for die adherence (push test).

4.2 The sample shall be inspected using the acceptance criteria of O.S. 1265.\* The die attach operation shall be inspected at 30X to 50X magnification. Chip damage and defects shall be inspected at 75X to 100X magnification.

4.3 Lots failing to meet N=5, C=0 for push test shall be rejected for 100% push testing.

## 5.0 PROCESS AUDIT:

5.1 Twice each day, a sample of 5 pieces will be taken from each die attach operation and inspected per O.S. 1265\* for visual and push test criteria. Information of defective units will be immediately taken to Production Foreman and Process Engineer.

5.2 Push Test:

N = 5, C = 0

\* For Arco and Medrad die attach, use MIL-STD-883, Method 2010, Condition A for IC's (cMos) and MIL-STD-750B, Method 2072 for transistors and diodes. Use magnification specified per applicable sections of 883 and 750.

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RAYTHEON COMPANY

Form 20-0044

Operation Standard	1276	
Sheet	1	Rev. 2
Date	July 8, 1975	
Subject	CENTRIFUGING HYBRID CIRCUITS	
	POC 75-6181 <i>HL</i>	

1.0 PURPOSE:

- 1.1 To specify a method of Centrifuging Hybrid Circuits to pull loose poor wire bonds and semiconductor chips.

2.0 SAFETY:

- 2.1 Normal precautions are to be observed.

3.0 EQUIPMENT AND TOOLS:

- 3.1 International Centrifuge size 2 Model V or equivalent.  
3.2 Electronic Counter #523D or equivalent.  
3.3 Centrifuge Fixture #2518 or equivalent.  
3.4 Damon IEC HT

4.0 MATERIALS AND SUPPLIES:

- 4.1 Hybrid Circuits

5.0 REQUIREMENTS:

- 5.1 All circuits to be Centrifuged in the Y1 DIRECTION.

6.0 PROCESS PROCEDURE: (International Centrifuge at Fixture #2518)

- 6.1 Place the circuits to be Centrifuged in the fixture with top of the circuit facing the outside of the fixture; this is the Y1 DIRECTION. Make sure the fixture is balanced by evenly spacing circuits around drum.  
6.2 Place the cover on the fixture and close centrifuge door.  
6.3 Check the Centrifuge Chart, Table I, for the G level at which you are going to Centrifuge the circuits. Centrifuge level is specified on the applicable Flow Charts.  
6.4 Turn on the Centrifuge powerstat to approximately 4 amp. until the Centrifuge Electronic Counter starts, then increase to 10 until the counter reaches the G level. Maintain this G level for 1 minute minimum.  
6.5 When the counter reaches the G level turn off the power, and apply pressure to the brake until Centrifuge stops.  
6.6 Open Centrifuge cover and remove circuits.  
6.7 Repeat for additional circuits.

1 2 3

2 1 1



RAYTHEON COMPANY

Operation Standard	1276	
Sheet	2	Rev. 1
Date	June 24, 1975	
Subject	CENTRIFUGING HYBRID CIRCUITS	

POC 75-6153 *6/24/75*

7.0 PROCESS PROCEDURE: (Damon IEC HT)

- 7.1 Place the circuits to be centrifuged in the fixture with top of the circuit facing the outside of the fixture, this is the Y1 direction. Make sure the fixture is balanced (load evenly distributed).
- 7.2 Place the cover on the fixture and close centrifuge door.
- 7.3 Check the flow chart for the G level at which to centrifuge the circuits.
- 7.4 Place speed control to zero.
- 7.5 Place power On/Off switch to "ON WITHOUT TIMER".
- 7.6 Place Brake/Run switch to "RUN".
- 7.7 Place Amp/RPM switch to "RPM".
- 7.8 Turn up speed control slowly.

CAUTION: DO NOT EXCEED 9 AMPS ON THE AMP METER AT ANY TIME

- 7.9 Stop speed control at the desired "G" level indicated on the calibration chart on the test machine. Maintain this level for one (1) minute.
- 7.10 After 1 minute turn speed control to zero.
- 7.11 Place Brake/Run switch to "BRAKE".
- 7.12 Turn speed control up slowly until Amp meter reads 2.5 amps.
- 7.13 When RPM meter reads 1, immediately turn speed control to zero.
- 7.14 Return Brake/Run switch to run.
- 7.15 Open centrifuge and remove circuits. Check for broken or damaged circuits.
- 7.16 Repeat procedure on additional circuits.

8.0 MAINTENANCE:

- 8.1 Check belt each week on International and adjust if needed.



RAYTHEON COMPANY  
INDUSTRIAL COMPONENTS DIVISION

Form 20-0044

Operation Standard	1276	
Sheet	3	Rev. 1
Date	June 24, 1975	
Subject	CENTRIFUGING HYBRID CIRCUITS	
	PC 75-6153 <i>Dec 6/24/75</i>	

CENTRIFUGE CHART

TABLE I

Frequency Counter at Various "G" Levels

"C.P.S. COUNTER READINGS"

"G" Level	3" Radius Ceramic Insert	2 15/16" Radius Metal Insert	3 3/16" Radius With No Insert
1,000	57.3 C.P.S.	57.9 C.P.S.	57
5,000	128 "	130	124
6,000	140 "	142	132
7,000	152	154	147
8,000	162	163	152
9,000	172	174	167
10,000	181	183	175
15,000	222	225	214
20,000	257	259	247
25,000	287	290	278
30,000	314	318	305

For Other Radii Calculate

C.P.S.=3.129

$$\sqrt{G/R}$$





Operation Standard		1297
Sheet 1	Rev. 15	
Date February 14, 1980		
POC 80-4169		

5.1

[illegible]



RAYTHEON COMPANY

Form 10-01144

Operation Standard	1297	
Sheet	2	Rev. 0
Date	Feb. 21, 1972	
Subject	POC 72-6013	

TEMPERATURE CYCLING HYBRID CIRCUITS

7.0 INSPECTION:

7.1 Inspect circuits for damaged leads, cracked packages, etc.

8.0 MAINTENANCE:

8.1 Calibrate the Hot and Cold chambers each month.

8.2 Check the Travel between the Hot and Cold chamber each month.



Form 20 0044

RAYTHEON COMPANY

Operation Standard	1297	
Sheet	3	Rev. 5
Date	Nov. 21, 1977	
Subject	TEMPERATURE CYCLING HYBRID CIRCUITS TEMPERATURE CYCLING	

TABLE I

CIRCUIT TYPE	NO. OF CYCLES	COLD TEMP.	MIN. TIME AT TEMP. (MINUTES)	MAX. TRANSFER TIME (MINUTES)	HOT TEMP.	MIN. TM. AT TEMP. (MINUTES)
Aerojet						
H60166	5	-55°C	30	5	85°C	30
H60167	5	-55°C	30	5	85°C	30
H60168	5	-55°C	30	5	85°C	30
Hawk						
H60096 H60383	5	-65°C	30	5	150°C	30
H60097	5	-65°C	30	5	150°C	30
H60098	5	-65°C	30	5	150°C	30
H60099	5	-65°C	30	5	150°C	30
H60100	5	-65°C	30	5	150°C	30
Loral						
H61214-H61246	10	-65°C	30	5	+150°C	30
H60218-H60221						
H61248-H61250						
RCA						
H60271	10	-55°C	10	5	+125°C	10
Santa Barbara	10	-55°C	10	5	+125°C	10
H60190-H60191						
H60198-H60199						
H60272-H60273						
H60274-H60275						
H60252-H60253						
H60254-H60255						
Sea Sparrow						
H60282-H60283	10	-55°C	10	5	125°C	10
TPN-19						
H60171	10	-55°C	10	5	+85°C or +125°C*	10

NOTE: Make sure the Machine Cycle Shut Off is higher than the Cycle Shut Off.

\* +125°C Before substrate soldering, 85°C after soldering or assembly.



RAYTHEON COMPANY

Operation Standard		1297
Sheet	A	Rev. 4
Date Nov. 21, 1977		
Subject		POC 77-6507

TEMPERATURE CYCLING HYBRID CIRCUITS  
TEMPERATURE CYCLING

TABLE I

Circuit Type	No. of cycles	Cold Temp.	Min. Time at Temp.Min.	Max. Transfer Time Min.	Hot Temp.	Min. Time At Temp. (minutes)
Magnavox						
H60235 H60405	5	-65°C	30	5	+150°C	30
H60236 H60406	5	-65°C	30	5	+150°C	30
H60237	5	-65°C	30	5	+150°C	30
Goleta						
H60289	10	-65°C	10	5	+150°C	10
H60290	10	-55°C	10	5	+125°C	10
Patriot Voltage Regulator						
H60372	10	-65°C	10	5	+125°C	10
H60373	↕	↕	↕	↕	↕	↕
H60374	↕	↕	↕	↕	↕	↕
H60375	↕	↕	↕	↕	↕	↕
H60378	↕	↕	↕	↕	↕	↕
H60379	10	-65°C	10	5	+125°C	10
Patriot RF Circuits						
H60600-500	5	-55°C	30	5	+85°C	30
H60601-501	↕	↕	↕	↕	↕	↕
H60602-500	↕	↕	↕	↕	↕	↕
H60603-500	↕	↕	↕	↕	↕	↕
H60604-500	↕	↕	↕	↕	↕	↕
H60605-500	↕	↕	↕	↕	↕	↕
H60606-500	↕	↕	↕	↕	↕	↕
H60607-500	↕	↕	↕	↕	↕	↕
H60607-501	↕	↕	↕	↕	↕	↕
H60607-502	↕	↕	↕	↕	↕	↕
H60608-500	↕	↕	↕	↕	↕	↕
H60608-501	5	-55°C	30	5	+85°C	30
Sidewinder 9L Circuits						
H60278A	10	-65°C	15	5	+150°C	15
H60385	10	-65°C	15	5	+150°C	15
HAMILTON/STANDARD						
H60389	10	-65°C	10	5	+150°C	10
H60390	↕	↕	↕	↕	↕	↕
H60391	↕	↕	↕	↕	↕	↕
H60392	↕	↕	↕	↕	↕	↕



RAYTHEON COMPANY

Form 20-0044

Operation Standard 1297	
Sheet 5	Rev. 4
Date Jan 26 80	
POC 80-4045	

Subject

TEMPERATURE CYCLING HYBRID CIRCUITS  
TEMPERATURE CYCLING

TABLE I

Circuit Type	No. of Cycles	Cold Temp.	Min. Time at Temp. Min.	Max. Transfer Time Min.	Hot Temp.	Min. Time At Temp. (Minutes)
Honeywell H60247	10	-55°C	10	5	+125°C	10
Magnavox USC-28						
H60483	10	-65°C	10	5	+150°C	10
H60484	10	-65°C	10	5	+150°C	10
H60485	10	-65°C	10	5	+150°C	10
H60486	10	-65°C	10	5	+150°C	10
H60487	10	-65°C	10	5	+150°C	10
H60488	10	-65°C	10	5	+150°C	10
Ford- Shillelagh						
H60478	10	-55°C	10	5	+125°C	10
H60479	↓	↓	↓	↓	↓	↓
H60480	↓	↓	↓	↓	↓	↓
H60481	↓	↓	↓	↓	↓	↓
H60482	↓	↓	↓	↓	↓	↓
G.E. H60410	10	-55°C	10	5	+125°C	10
AMS- H60366	10	-65°C	10	5	+150°C	10
H60367	↓	↓	↓	↓	↓	↓
H60467	↓	↓	↓	↓	↓	↓
H60468	↓	↓	↓	↓	↓	↓
H60469	↓	↓	↓	↓	↓	↓
H60470	↓	↓	↓	↓	↓	↓
9M Cell Amp- H60462	10	-65°C	10	5	+150°C	10
Cage- H60502	10	-55°C	10	5	+125°C	10



Form 20 0044

RAYTHEON COMPANY

Operation Standard 1297	
Sheet 6	Rev. 1
Date February 14, 1980	
POC 80-4169	

Subject

TEMPERATURE CYCLING HYBRID CIRCUITS

TABLE I Cont.

CIRCUIT TYPE	No. of Cycles	Cold Temp.	Min. Time at Temp. Min.	Max. Transfer Time Min.	Hot Temp.	Min. Time At Temp. (Minutes)
Amraam- H60454 H60455 H60457 H60490 H60491 H60492 H60493 H60494 H60495 H60496	10 ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓	-65°C ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓	10 ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓	5 ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓	+150°C ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓	10 ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓
RCA- H60510 H60511 H60512 H60513 H60514 H60515 H60516 H60517 H60518 H60519 H60520 H60521 H60522 H60523	10 ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓	-55°C ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓	10 ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓	5 ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓	+125°C ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓	10 ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓
Northrop H60451 H60452	10 10	-65°C -65°C	10 10	5 5	+150°C +150°C	10 10
Singer H60446	10	-65°C	10	5	+150°C	10
Magnavox H60483 H60484 H60486 H60487 H60488	10 10 10 10 10	-65°C -65°C -65°C -65°C -65°C	10 10 10 10 10	5 5 5 5 5	150°C 150°C 150°C 150°C 150°C	10 10 10 10 10



RAYTHEON COMPANY

Operation Standard		1385
Sheet	1	Rev. 5
Date September 21, 1978		
POC 78-6515		

5. /

**1.0 PURPOSE:**

- 1.1 To specify a method of cleaning substrates before die attach and after dynamic trim to remove trimming and other foreign particles.

## 2.0 SAFETY:

- 2.1 Normal precautions are to be observed for handling cleaning solutions.
- 2.2 Operator is to wear finger cots.

### 3.0 EQUIPMENT AND TOOLS:

- 3.1 Ink Eraser #853
- 3.2 Pyrex Beaker
- 3.3 Cobehn Spray Equipment #B6/8/9 1/2/2AAY
- 3.4 Grounding Fixture
- 3.5 Clean Metal Trays
- 3.6 Exhaust Hood
- 3.7 Oven (125°C)
- 3.8 Hot plate 125°F  $\pm$  10°F
- 3.9 Tweezers
- 3.10 Metal hood for hot plate
- 3.11 Stainless Steel Basket
- 3.12 Ultrasonic Cleaner
- 3.13 Nitrogen Storage Cabinet

#### 4.0 MATERIALS AND SUPPLIES:

- 4.1 Cobehn  
4.2 Isopropyl alcohol (electronic or Mos grade)  
4.3 Conductive elastomeric #40-XX-1010-1212 or equivalent.  
4.4 Finger cots  
4.5 Acetone - electronic or Mos grade  
4.6 Trichloroethylene - electronic or Mos grade  
4.7 Nitrogen blow line

## 5.0 REQUIREMENTS:

- 5.1 Substrates and attached components must be free of all foreign matter.

[illegible]



# RAYTHEON COMPANY

Operation Standard 1385	
Sheet 2	Rev. 4
Date September 21, 1978	
POC 78-6516	

**Subject** CLEANING SUBSTRATES PRIOR TO DIE ATTACH AND AFTER DYNAMIC ADJUST FOR HAWK (ALL TYPES) TPN-19 AND APP

## 6.0 PROCESS PROCEDURE:

### 6.1 Prior to Die Attach Only:

- 6.1.1 Abrade gold and (on TPN-19 and APP only) platinum-gold conductors with ink eraser until uniformly shiny. Pay particular attention to corners and along inside edges near corral.
- 6.1.2 Blow off substrates with nitrogen to remove eraser particles.
- 6.1.3 Place the units in a basket. Place the basket in the glass beaker filled with Trichloroethylene.
- 6.1.4 Place the beaker in ultrasonic cleaner and clean for  $3\frac{1}{2} \pm \frac{1}{4}$  minutes.
- 6.1.5 Lift the basket and rinse the modules in the basket using fresh Trichloroethylene.
- 6.1.6 Repeat above 6.1.3, 6.1.4 and 6.1.5 using Acetone.
- 6.1.7 Repeat above 6.1.3, 6.1.4 and 6.1.5 using Isopropanol.
- 6.1.8 Blow dry the units with Nitrogen gas.
- 6.1.9 Place the units on a tray covered with lint free paper.
- 6.1.10 Dry the units in an oven at  $125^{\circ}\text{C} \pm 5^{\circ}\text{C}$  for  $\frac{1}{2}$  hr  $\pm$  5 min.
- 6.1.11 Store the trays in a closed cabinet filled with Nitrogen until ready for use.

### 6.2 DYNAMIC ADJUST (HAWK AND TPN-19 ONLY)

NOTE: It is important that the following procedure is strictly adhered to when cleaning units after dynamic adjust.

- 6.2.1 Check that air pressure at Cobehn unit is 40 PSI.
- 6.2.2 Check that temperature gauge reads between  $90^{\circ}\text{C}$  and  $110^{\circ}\text{C}$ .
- 6.2.3 Check that ground lead of fixture is secure.
- 6.2.4 Put on finger cots before handling modules.
- 6.2.5 Load one or two modules into fixture as shown in Figure 1.





# RAYTHEON COMPANY

Form 20-0044

Operation Standard	1385	
Sheet	3	Rev. 2
Date	September 21, 1978	
Subject	CLEANING SUBSTRATES PRIOR TO DIE ATTACH AND AFTER DYNAMIC ADJUST FOR HAWK (ALL TYPES) TPN-19, APP.	
	POC 78-6515	

## 6.2 DYNAMIC ADJUST (HAWK AND TPN-19 ONLY) Cont.

- 6.2.6 Hold fixture with modules facing spray nozzle approximately 2 inches from the nozzle. Spray units with dry air for approximately 10 seconds.
- 6.2.7 Spray with Cobehn by depressing foot pedal, holding fixture no closer than 2 inches from nozzle and no farther than 2.5 inches from nozzle. Spray for 3.5 seconds moving fixture as necessary to direct spray over the entire surface of exposed module or modules.
- 6.2.8 Release foot pedal and spray units with dry air for approximately 8 seconds.
- 6.2.9 Remove modules from fixture and immerse in isopropyl alcohol, swish around once and place in hot plate for 2 to 5 minutes. Place on a clean metal tray, face down.
- 6.2.10 Continue preceeding steps on all modules.
- 6.2.11 Store in a dry nitrogen cabinet until the next operation.

## 7.0 INSPECTION:

- 7.1 Inspect under a 40X microscope for trimming particles and other foreign matter.

## 8.0 MAINTENANCE:

- 8.1 Check Cobehn heater temperature and air pressure daily and during use.
- 8.2 If an automatic timer is in use for regulating time cycles of spray, check times of cycles daily.



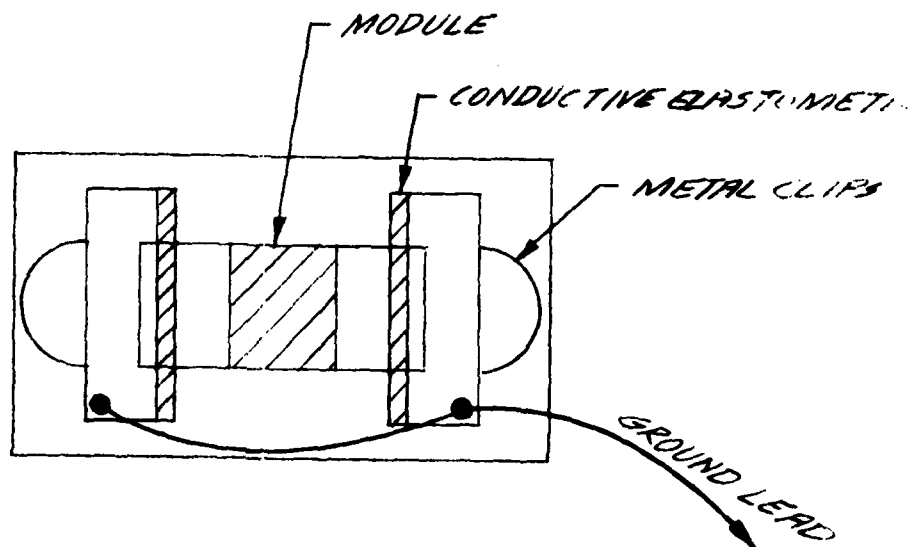
RAYTHEON COMPANY  
INDUSTRIAL COMPONENTS DIVISION

Form 20-0044

Operation Standard 1385	
Sheet 4	Rev. ( )
Date Dec. 19, 1974	
POC 74-6341	

Subject CLEANING SUBSTRATES PRIOR TO DIE ATTACH  
AND AFTER DYNAMIC ADJUST FOR HAWK (all types)  
AND TPN-19

Figure I



Operation Standard		1394
Sheet	1	Rev. 2
Date March 3, 1980		
POC 80-4219		

**Subject**

### HELIUM LEAK TEST AFTER CORRAL ATTACH

POC 80-4219

1.0 PURPOSE:

To specify a method of fine leak testing Hermetically corral sealed Hybrid Circuits using Helium leak detector.

## 2.0 SAFETY:

2.1 Normal precautions are to be observed.

### 3.0 EQUIPMENT AND TOOLS:

3.1 Helium leak detector VEECO MS-12 or equivalent.

3.2 Oven 0-260°C Blue M#OV-490A-1 or equivalent.

5.5 Ultraviolet Lamp #B-100A or equivalent.

#### 4.0 MATERIALS AND SUPPLIES:

#### 4.1 Helium

## 4.2 Hybrid Circuits

#### 4.3 Vacuum Grease - Celvacene Heavy

#### 4.4 Axothene VG (Electronic Grade)

#### 4.5 Acetone (Electronic Grade)

#### 4.6 Iso-Propyl Alcohol (Electronic Grade)

## 5.0 REQUIREMENTS:

5.1 No Helium leaks.

## 6.0 PROCESS PROCEDURE:

6.1 Helium leak detector to be calibrated before using.

6.2 Push the vent switch, and then place circuit on rubber fixture with a small amount of vacuum grease.

[illegible]



RAYTHEON COMPANY

Form 20-0044

Operation Standard	1394	
Sheet	2	Rev. 1
Date	March 14, 1978	
Subject	POC 78-6105	

## 6.0 Continued

6.3 Push the start switch and wait until (ready for test) light comes on then spray Helium over unit using funnel to contain Helium within the area of unit.

6.4 Circuits that read greater than the limits in Table 1 shall be marked as rejects.

Note: Blow off unit before proceeding to Step 6.5 to eliminate excess Helium from going into vacuum system.

6.5 Push the switch to vent, and remove the circuit and place in a beaker of Axothene VG.

6.6 Repeat for additional circuits.

6.7 When lot is finished, clean the unit as follows:

A. Soak in Axothene VG for 3-5 minutes.

B. Rinse twice with Axothene VG

C. Rinse in Acetone

D. Rinse in Iso-propyl Alcohol

E. Dry in oven at  $125^{\circ}\text{C} \pm 5^{\circ}\text{C}$  for 5 minutes.

Note: Check each unit under ULTRAVIOLET LAMP to make sure all vacuum grease has been removed, if not, repeat 6.7.

When finished with lot, place the Leak Detector switch back into the start position.

7.0 INSPECTION:

7.1 All vacuum grease has been removed.

8.0 MAINTENANCE:

8.1 Calibrate Helium leak detector each day or before using.



## RAYTHEON COMPANY

Operation Standard	1394	
Sheet	3	Rev. 2
Date	March 3, 1980	
Subject	HELIUM LEAK TEST AFTER CORRAL ATTACH	
	POC 80-4219	

## 8.0 Continued:

8.2 Shut Down:

- A. Push the vent switch, and place in the metal plug into the leak detector.
- B. Push the start switch, and wait until the vacuum pulls down below the red indicator.
- C. Place the switch back to (STANDBY) do not Vent.
- D. Turn the FILAMENT OFF.
- E. Turn off the Electronic Switch.

8.3 Start Up:

- A. Turn on the Electronic Switch.
- B. Push the START switch ON.
- C. Fill the cold trap with liquid nitrogen.
- D. Turn the filament ON.
- E. Leave the Leak Detector on for 1/2 hour before starting to calibrate.

8.4 Calibrate:

- A. Push the switch to Vent, and remove the metal plug from the leak detector.
- B. Place in the SENSITIVITY CALIBRATOR TYPE SC-4 into the leak detector, and push the switch to start.
- C. When the Ready to Test light comes on, turn the leak rate meter to the  $9 \times 10^{-8}$  scale.
- D. Open sensitivity calibrator valve and adjust controls so that leak rate agrees with the Calibrator rate.

TABLE I

Table I  
Module Type  
H60096-100  
H60171  
H60243

Max. Limit  
cc/sec.  
 $5 \times 10^{-8}$   
 $5 \times 10^{-7}$   
 $5 \times 10^{-8}$



RAYTHEON COMPANY

Form 20-0044

Operation Standard		1394
Sheet	4	Rev. 0
Date March 3, 1980		
Subject		POC 80-4219

8.4 Calibrate:TABLE I (cont.)

	<u>Table I</u> <u>Module Type</u>	<u>Max. Limit</u> <u>cc/sec.</u>
RCA	H60511	5 x 10 <sup>-8</sup>
	H60516	5 x 10 <sup>-8</sup>
	H60517	5 x 10 <sup>-8</sup>
	H60518	5 x 10 <sup>-8</sup>
	H60522	5 x 10 <sup>-8</sup>
AMS	H60366	5 x 10 <sup>-8</sup>
	H60367	5 x 10 <sup>-8</sup>
	H60468	5 x 10 <sup>-8</sup>
	H60469	5 x 10 <sup>-8</sup>
	H60470	5 x 10 <sup>-8</sup>
AMRAAM	H60454	5 x 10 <sup>-8</sup>
	H60455	5 x 10 <sup>-8</sup>
	H60457	5 x 10 <sup>-8</sup>
	H60490	5 x 10 <sup>-8</sup>
	H60491	5 x 10 <sup>-8</sup>
	H60492	5 x 10 <sup>-8</sup>
	H60493	5 x 10 <sup>-8</sup>
	H60494	5 x 10 <sup>-8</sup>
	H60495	5 x 10 <sup>-8</sup>
	H60496	5 x 10 <sup>-8</sup>



## RAYTHEON COMPANY

Form 20-0044

Operation Standard	1470	
Sheet	1	Rev. 3
Date	October 22, 1979	
Subject	IN-PROCESS INSPECTION OF THE THICK FILM SCREENING AND CORRAL ATTACH OPERATIONS	
	POC 79-6775	

1.0 PURPOSE:

This standard is to provide control for screening and corral attach operations using visual criteria.

2.0 EQUIPMENT:

10X to 30X stereozoom microscope with provision for transmitted light.

3.0 DOCUMENTATION:

O.S. 1265  
Applicable screened substrate drawing  
Applicable lot traveler  
Data sheet of Appendix A

4.0 FREQUENCY OF INSPECTION:

At approximately 8:30 A.M. - 11:00 A.M. and 2:30 P.M.

5.0 SAMPLE SIZE:

Sample size shall be five (5) units for all inspections.

6.0 PROCEDURE:

- 6.1 The inspector shall draw the required sample after the screening and drying sequence, and for corrals after the corral attach firing sequence. The inspector shall also check other start-up parameters as detailed in paragraph 7.2 and record these results on the data sheet of sheet 3.
- 6.2 Using the stereomicroscope, the inspector shall inspect the sample to the criteria of O.S. 1265 and record all data as detailed on the data sheet of Appendix A. The inspection criteria of O.S. 1265 is modified for this inspection to the extent detailed in paragraph 7.0.
- 6.3 Samples with one or more defects shall be cause for rejection.
- 6.3.1 If one defect is found the cognizant supervisor shall be notified.
- 6.3.2 If two or more defects are found the inspector shall notify the cognizant supervisor and the process shut down until an acceptable sample is obtained.

1 2 3

3 2 0



RAYTHEON COMPANY

Form 20 -0044

		Operation Standard	1470
		Sheet	2
		Rev.	2
		Date	Dec. 8, '975
Subject		IN-PROCESS INSPECTION OF THE THICK FILM SCREENING AND CORRAL ATTACH OPERATIONS	
		POC 75-6327	

6.0 PROCEDURE: Cont.

- 6.3.3 The cognizant inspection foreman or Q.C. engineer shall be notified if two successive checks indicate the same defect item.

7.0 REJECTION CRITERIA:

- 7.1 Rejection shall be based on the defect criteria of O.S. 1265, but with the following alterations:

- 7.1.1 The terms "Minor", "Major", and "Information only" shall be disregarded.
- 7.1.2 O.S. 1265 - Item 102 criteria shall be - Location of conductor or other screened element is outside of registration on applicable drawing or specification by more than .010". However, pads .025" x .025" or smaller may not be misregistered by more than .005".
- 7.1.3 O.S. 1265 item 103 - Spacing change the spacing requirement from .002" to .003".
- 7.1.4 O.S. 1265 item 302 and 303 disregard. Substitute as follows "Voids greater than .005" or 1/2 the width of the conductor pattern, whichever is less, are deemed rejectable."
- 7.1.5 O.S. 1265 item 403, change void dimension from "Greater than .010" to "Greater than .003".

- 7.2 Rejection shall also be based on the following start-up inspections.

- 7.2.1 Paste type must conform to that specified on the applicable assembly drawing or on paste test document in the case of resistor pastes.
- 7.2.2 Paste jar must have affixed thereto an acceptance stamp indicating approval at receiving inspection.





## RAYTHEON COMPANY

Form 20-0044

Operation Standard	1491	
Sheet	1	Rev. 3
Date	June 20, 1978	
Subject	GOLD PASTE APPROVAL PROCEDURE	
	POC 78-6333	

1.0 PURPOSE:

This procedure details the steps for approval of gold paste used for conductor material on thick film microelectronic substrates.

2.0 SCOPE:

Two general procedures are contained herein. The first procedure outlines the steps for approval of paste used in monolayer circuits. The second procedure outlines the steps used in multilayer circuits.

3.0 GENERAL OUTLINE:

The procedures are grouped into five basic steps. They are:

- 3.1 Receipt of paste and M.I.D. processing.
- 3.2 Paste room analysis and accountability.
- 3.3 Production of samples.
- 3.4 Testing of samples.
- 3.5 Engineering Analysis of test results and disposition of paste.

Note: Procedural elements of items 3.1; 3.2; and 3.5 are identical for both monolayer and multilayer pastes.

4.0 EQUIPMENT (Equivalent Items May be Used)

Brush Surf Analyzer  
6 place digital ohmmeter  
Stereozoom microscope (10X to 30X)  
Rotovisco viscosity analyzer  
Balance scale with 0.1g. divisions  
Screens 30501 and 30502.  
Screen 30276-2  
Partical size analysis wedge  
Presco screener  
G.E. Dryer  
Watkins Furnace (Firing)  
Screen Tension Gage  
Spatula  
Wiping Cloth (lintless)  
Loading Trays

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	3	0	0	0	1	2	2	0	0	0	1	0	2	2	2	1	0	1	1	3	1



Form 20-0044

## RAYTHEON COMPANY

		Operation Standard 1491	
		Sheet 2	Rev. 0
		Date Dec. 16, 1974	
Subject GOLD PASTE APPROVAL PROCEDURE		POC 74-6252	

## 5.0 DOCUMENTATION:

O.S. 1034 Operation of Rotovisco Unit  
O.S. 1265 Workmanship Criteria for Microelectronic Program  
O.S. 1007 Screening and Firing Electrodes  
O.S. 1012 Firing Schedules - Furnace Profiles  
O.S. 1455 Mfg. of Sc. Printed F. Line Multilayer Substrates  
O.S. 1025 Die Attach Procedure  
O.S. 1026 Wire Bond Procedure  
O.S. 1029 Ultrasonic Bonding  
O.S. 1420 Beam Lead Bonding  
Referenced documents of above Operation Standards.

## 6.0 PROCEDURE:

6.1 Receipt of paste from vendor:

- 6.1.1 No delay shall be allowed in the handling of gold paste materials from receipt of paste until delivery to Stores. If paste cannot be delivered to Stores through M.I.D. within the time frame of one shift, the paste shall be retained by the Receiving Dept. under lock until the next working shift.
- 6.1.2 The Material Inspection Dept. shall review paste label data for conformance with purchase order requirements.
- 6.1.3 The label data shall be recorded on an appropriate data sheet along with received date, lot no. and issue date to Stores. (See Appendix B)
- 6.1.4 If any discrepancies are noted during this examination, the cognizant Quality Control Engineer shall be consulted for disposition of the material.
- 6.1.5 A paste approval data form (Appendices C & D) shall be forwarded with the lot to Stores.
- 6.1.6 Store room personnel shall record pertinent information on inventory records and forward the paste to the "Paste Room" on the same day.
- 6.1.7 Paste room personnel shall record the receipt of the paste and maintain segregation and security of the unapproved material.



# RAYTHEON COMPANY

Operation Standard	1491	
Sheet	3	Rev. 0
Date	Dec. 16, 1974	
Subject	POC 74-6252	

Subject

GOLD PASTE APPROVAL PROCEDURE

6.0 Cont.

## 6.2 Paste Room Sampling and Analysis:

6.2.1 The paste room technician shall check and record:

paste viscosity, net weight, and particle size distribution. Refer specification sheet of Appendix E.

6.2.1.1 Paste viscosity shall be checked using the Roto-Visco Unit according to O.S. 1034.

6.2.1.2 Net weight of paste shall be measured to the nearest gram. A standard weight for the container and cover shall be assumed.

6.2.1.3 Particle size distribution shall be measured in accordance with O.S. 1475.

6.2.1.4 If lots are rejectable to net weight and/or particle size distribution criteria, disposition of the lot shall be made prior to continuance of lot approval.

## 6.2.2 Paste Sampling for Paste Approval:

6.2.2.1 The paste technician shall mix the paste with a clean spatula for ten minutes.

6.2.2.2 Approximately one to two ounces shall be transferred to a 1 fl. ounce plastic jar provided for testing purposes. The weight of the sample shall be recorded in the material usage log book. Paste sample shall be properly identified.

6.2.2.3 The paste sample shall be delivered to the paste approval screening technician with the data form of Appendix C or D.

## 6.3 Monolayer Devices - Screening of Sample Substrates: (See Par. 6.6 for multilayer)

6.3.1 Paste types for monolayer circuits analysis.

6.3.1.1 8237, 8115, 8831,

6.3.2 Total sample size - six substrates (use substrate P/N 26219-49)

6.3.3 Screen six "best effort" substrates with subject paste using screen 30276-1 per O.S. 1007.

Note: Test substrates shall be marked "one" to "six".



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## RAYTHEON COMPANY

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		Sheet	4
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		Date	Dec. 16, 1974
Subject		POC 74-6252	
GOLD PASTE APPROVAL PROCEDURE			

6.0 Cont.

6.3.4 Rescreen substrates one and two per O.S. 1007.

6.3.5 Fire all six substrates two times per O.S. 1012.

6.4 Testing/Inspection of Sample Substrates (Monolayer)

6.4.1 Check substrates one and two for bubbling under 30X &amp; 60X magnification and record data on data sheet of Appendix C.

6.4.2 Submit substrates 3 through 6 to visual examination under 10X to 30X magnification per the criteria of O.S. 1265, Section 300 and the applicable items of Section 100. Record information on data sheet of Appendix C.

6.4.3 Submit the four substrates to the cognizant Quality Control Engineer for resolution evaluation. Results shall be recorded on the data sheet of Appendix C.

6.4.4 Check resistivity run of all substrates per the instruction of Appendix A. Record results on the data sheets on Appendices A-1 and C.

6.4.5 Submit substrates 3 through 6 to the Chip and Wire Dept. for attachment testing.

6.4.5.1 Submit 1 piece for beam lead device attachment per O.S. 1420. Five devices shall be attached to the sample substrate. The sample attachments shall be subjected to inspection per the criteria of par. 8 of O.S. 1265.

6.4.5.2 Submit 1 piece for thermo-compression wire bonding per O.S. 1026. Fifty stitch bonds shall be made using production gold wire. The bonds shall be evaluated to the applicable criteria of O.S. 1265 par. 3. All fifty wires shall be pulled for evaluation to the criteria of par. 3.16 of O.S. 1265.

6.4.5.3 Submit 1 piece for ultrasonic wire bonding per O.S. 1029. Same test as in 6.4.5.2.



## RAYTHEON COMPANY

Operation Standard	1491	
Sheet	5	Rev. 1
Date	March 5, 1975	
Subject	GOLD PASTE APPROVAL PROCEDURE	
	POC 75-6050	

6.0 Cont.

6.4.5.4 Submit 1 piece for die attachment. Ten (10) dice shall be attached using eutectic bonding technique per O.S. 1025. The bonded dice shall be evaluated to the applicable criteria of O.S. 1265, Sheet 8.

6.4.5.5 All inspection results of paragraph 6.3.9 shall be recorded on the data sheet of Appendix C. All samples shall be forwarded with the data sheet in such a manner to prevent handling damage.

#### 6.5 Engineering Review and Disposition:

6.5.1 The cognizant Quality Control and Screening Engineers shall review all approval data and provide disposition on the approval form of Appendix E. Any use restrictions shall be noted on the form.

6.5.2 Copies of the approval and data forms shall be forwarded to M.I.D.; the Paste Room technician, and the cognizant Screening Room Engineer. If restrictions are noted on the approval form an extra copy shall be forwarded to M.I.D. A copy of the approval form only shall be forwarded to Production Control.

6.5.3 Upon receipt of an approved form, the M.I.D. inspector shall label the subject paste jar with either an accept or reject notation. If a restriction is noted on the approval form, a notation on the jar shall be placed with the words "Restricted - Use". A copy of the approval form shall also be provided by M.I.D. and placed with the subject jar, if the jar has a use restriction.

6.5.4 Rejected jars shall be placed in a special "Reject Drawer" until appropriate disposition of the rejected jar is made.

#### 6.6 Screening and Testing of Sample Substrates for Multilayer Devices: Refer to Sheet 20 for Applicable Paste Types.

6.6.1 Total sample size - 12 pieces.

6.6.2 Apply numbers to each test substrate - "one" to "twelve"

6.6.3 Screen conductor material under test on all test substrates per O.S. 1007 using screen 30502.

6.6.4 Fire all twelve substrates per O.S. 1012.

\*Refer Appendix G for applicable dielectric material.



## RAYTHEON COMPANY

Form 20-0044

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		Sheet	6
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		Date	April 25, 1975
Subject	GOLD PASTE APPROVAL PROCEDURE		POC 75-6081

## 6.0 Cont.

- 6.6.5 Screen dielectric on half the substrate using screen no. 30276-2. Dielectric material will be determined by Engineering prior to start of test. Refer O.S. 1455. (12 pieces)
- 6.6.6 Fire dielectric per O.S. 1455. (12 pieces)
- 6.6.7 Screen conductor material under test on all test substrates per O.S. 1007 using screen no. 30501. This gold screening is screened on the dielectric surface.
- 6.6.8 Fire all substrates per O.S. 1012.
- 6.6.9 Substrates one, two, ten and eleven, rescreen subject gold paste per O.S. 1007 using screen 30501.
- 6.6.10 Fire substrates one and two per O.S. 1012 and O.S. 1007.
- 6.6.11 Substrates 5 through 8, refire an additional two times per O.S. 1012.
- 6.6.12 Substrates 9 through 12, refire an additional 13 times per O.S. 1012.
- 6.6.13 Visually inspect substrates one and two for bubbling under 30X magnification and record data on data sheet of Appendix D. Repeat examination under 60X.
- 6.6.14 Visually inspect substrates one and two to the criteria of O.S. 1265, 300 series.
- 6.6.15 Screen substrates one, two, three, and four with dielectric using screen 30501 per O.S. 1455.
- 6.6.16 Fire substrates one through four per O.S. 1455.
- 6.6.17 Rescreen substrates one through four with dielectric using screen 30276-2 per O.S. 1455\*.
- 6.6.18 Fire substrates one through four per O.S. 1455.
- 6.6.19 Submit substrates one through four to Quality Control Inspection for evaluation of bubbling effects of dielectric on gold. Results are to be recorded on the data sheet of Appendix D. Check under 30X and 60X magnification. Testing of substrates 1, 2, 3, and 4 ends with this examination. Seal in envelopes and retain with test lot.

\*Refer Appendix G for applicable dielectric material.



RAYTHEON COMPANY

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	Operation Standard	1491
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	Date	April 25, 1975
Subject	GOLD PASTE APPROVAL PROCEDURE	
	POC 75-6081	

## 6.0 Cont.

- 6.6.20 Check substrates 7, 8, 11, 12 for gold resistivity according to the instruction of Appendix A. Record data on Appendix A-1 and D.
- 6.6.21 Submit substrates seven through twelve to Quality Control Inspection for evaluation of resolution. Results are to be recorded on the data sheet of Appendix D.
- 6.6.22 Check substrates five through twelve visually to the criteria of O.S. 1265, 300 series. Also check substrates 9 - 12 for gold/glass segregation under 200-300X magnification.
- 6.6.23 Check substrates 5 through 12 for quality of the following attachments. See schedule below. Results are to be recorded on the data sheet of Appendix D. Follow the instruction of paragraph 6.4.5.
  - 6.6.23.1 Beam lead attach-substrates 5 and 9.
  - 6.6.23.2 Thermocompression wire bond-substrates 6 and 10.
  - 6.6.23.3 Ultrasonic wire bond-substrates 7 and 11.
  - 6.6.23.4 Eutectic die attachment-substrates 8 and 12.
- 6.7 Engineering Review and Disposition of Multilayer Gold Paste Test Results. Follow instruction of paragraph 6.5.

Note: A combination of acceptable results for substrates 5 through 8 and rejectable results for substrates 9 through 12 may result in the downgrading of multilayer gold paste to monolayer application.



RAYTHEON COMPANY

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Operation Standard	1491	
Sheet	8	Rev. 0 n.
Date	Dec. 16, 1974	
Subject	POC 74-6252	

- 1.0 Using a six place digital multimeter check resistance of resistivity run on test substrate. (Use four point probe).
- 2.0 Using the Brush Surface Analyzer check the height of the resistivity run in five places.
- 3.0 Determine an average of the five height readings of 3.0 above by adding the five readings and dividing by 5.
- 4.0 Multiply the average height reading in mils (reading in inches times one thousand) times the resistance of the resistivity run from "1" above.
- 5.0 Divide the results of "4" above by 350 which is the number of squares of the resistivity run. This net result is the resistivity of the paste.
- 6.0 Record the results of "5" above for each substrate on Appendix A-1 and Appendix C or D.
- 7.0 Formula -

$$\frac{R \times \left( \frac{h_1 + h_2 + h_3 + h_4 + h_5}{5} \right)}{350} = \text{Resistivity}$$

R= Resistance reading of run

h, etc. = height reading in mils  
(Record readings on Appendix A-1)





RAYTHEON COMPANY

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Operation Standard	1491	
Sheet	9	Rev. 0
Date	Dec. 16, 1974	
Subject	GOLD CONDUCTOR PASTE RESISTIVITY CALCULATION APPENDIX A-1	
	POC 74-6252	

(A) Sub. No.	(B) Net Resistance	(C) 1	(D) 2	(E) 3	(F) 4	(G) 5	(H) Height Total	(I) Avg. Height
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								

(Place readings adjacent to appropriate substrate no.)

Avg. Hgt. = Height Total  $\div$  5Resistivity =  $\frac{BI}{350}$ 

Result:

Sub. No.	Resistivity $\Omega/\square$
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	



RAYTHEON COMPANY

Form 20-0044

Operation Standard	1491	
Sheet	10	Rev. 0
Date	Dec. 16, 1974	
Subject	PASTE RECEIVAL AND RECORD FILE (MID FORM) APPENDIX B	
	POC 74-6252	

Date Received: \_\_\_\_\_

Date Approved/Rejected: \_\_\_\_\_

Part No.: \_\_\_\_\_

Paste Name: \_\_\_\_\_

MID Lot No.: \_\_\_\_\_

Vendor: \_\_\_\_\_

P. O. No.: \_\_\_\_\_

Vendor Lot No.: \_\_\_\_\_

Vendor P/N \_\_\_\_\_

Weight per jar from Label \_\_\_\_\_

Other Label Data \_\_\_\_\_

Accepted: ☐Rejected: ☐

Restrictions - List Below:

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Reason for Rejection and Disposition:

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GOLD PASTE APPROVAL ROUTE AND DATA SHEET  
(Monolayer Paste)

M.I.D. Lot No. \_\_\_\_\_

Appendix C

Op No.	Oper. Name	O.S. No.	No. Pcs.	Date		Oper/ Insp.	Mach. No.	Data
				In	Out			
9	Beam Lead Attach	1420	1					
10	Beam Lead Inspect	1265	1					
11	Thermo-com. Wire Bond	1026	1					
12	Visual Insp. Wire Bonds	1265	1					
13	Pull Test Wire Bond	1265	1					
14	Ultrasonic Wire Bond	1029	1					
15	Visual Inspect Wire Bond	1265	1					
16	Pull Test Wire Bonds	1265	1					
17	Die Attach	1025	1					
18	Visual Inspect	1265	1					
19	Push Test Die Attach	1265	1					

GOLD PASTE APPROVAL ROUTE AND DATA SHEET  
(Multilayer Paste)

O.S. 1491  
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Appendix D

Jar No.

Test Vehicle-Substrate  
With Dielectric P/N

Paste No. Under Test

Vendor  P.O. No.  Viscosity as Rec'd

M.I.D. Lot No.  Date Rec'd  Viscosity Adjusted to

Vendor Lot No.  Paste Weight  Particle Size Distribution

Op. No.	Oper. Name	O.S. No.	Paste No.	Jar No.	Screen No.	No. Pcs.	Date		Oper/ Insp. No.	Mach. No.	Data
							In	Out			
1	Mark Substrate					12					
2	Screen Substrates	1007				12					
3	Fire	1007 1012				12					
4	Screen Dielectric	1455			30276-2	12					
5	Fire Dielectric	1455				12					
6	Screen Conductor	1007			30501	12					
7	Fire Conductor	1012 1007				12					
8	Rescreen 4 Subs. Nos. 1,2,10 & 11	1007			30501	4					
9	Fire Subs. 1 and 2	1012 1007				2					
10	Fire 2 Times Subs. 5 to 8	1012 1007				4					1. _____ 2. _____

GOLD PASTE APPROVAL ROUTE AND DATA SHEET  
(MULTILAYER PASTE)

O.S. 1491  
Page 14 Rev. 2  
Appendix D

M.I.D. Lot No. \_\_\_\_\_

Op. No.	Oper. Name	O.S. No.	Paste No.	Jar No.	Screen No.	No. Pcs.	Date		Oper/ Insp.	Mach. No.	Data
							In	Out			
11	Fire 13 Times Subs. 9 to 12	1012 1007				4					
12	Inspect Visually For Bubbling Subs. 1 & 2					2					
13	Visual Inspect Subs. 1 and 2	1265				2					
14	Screen Die- lectric Subs. 1 - 4	1455	8399		30276-2	4					
15	Fire Subs. 1 - 4	1455									
16	Rescreen Die- lectric Subs. 1 - 4	1455	8399		30276-2	4					
17	Fire Subs.	1455				4					
18	Inspect Visually For Bubbling					4					1 _____ 2 _____ 3 _____ 4 _____
19	Resistivity of Gold Inspection Subs. 7,8,11,12					4					Record Readings on Appendix A-1 Transfer final results here. (ohms) / _____
19A	Resistance Check										7 _____ 8 _____
19B	Height Check					4					11 _____ 12 _____

GOLD PASTE APPROVAL ROUTE AND DATA SHEET  
(Multilayer Paste)

M.I.D. Lot No. \_\_\_\_\_

Op. No.	Oper. Name	O.S. No.	No. Pcs.	Date		Oper/ Insp.	Data
				In	Out		
20	Resolution Evaluation 7 - 12		6				
21	Visual Inspection Nos. 5 - 12 Glass Segregation, etc.	1265 See App. F	8				
22	Beam Lead Attach Nos. 5 & 9	1420	2				
23	Beam Lead Inspect Nos. 5 & 9	1265	2				
24	Thermo Compression Wire Bond Nos. 6 & 10	1026	2				
25	Visual Insp. Wire Bonds Nos. 6 & 10	1265	2				
26	Pull Test Wire Bonds Nos. 6 & 10	1265	2				

GOLD PASTE APPROVAL ROUTE AND DATA SHEET  
(Multilayer Paste)

M.I.D. Lot No. \_\_\_\_\_

Appendix D

Op. No.	Oper. Name	O.S. No.	No. Pcs.	Date		Oper/ Insp.	Data
				In	Out		
27	Ultrasonic Wire Bond Nos. 7 & 11	1029	2				
28	Visual Inspect Wire Bonds Nos. 7 & 11	1265	2				
29	Pull Test Wire Bonds	1265	2				
30	Die Attach Nos. 8 & 12	1025	2				
31	Visual Inspect Die Attach	1265	2				
32	Push Test Die Attach	1265	2				





RAYTHEON COMPANY

Form 20-0044

Operation Standard	1491	
Sheet	17	Rev. 0
Date	Dec. 16, 1974	
Subject	ENGINEERING APPROVAL VERIFICATION APPENDIX E	
POC 74-6252		

Paste Type No.: \_\_\_\_\_

Name: \_\_\_\_\_

MID Lot No.: \_\_\_\_\_

Jar No.: \_\_\_\_\_

Vendor: \_\_\_\_\_

Vendor Lot No.: \_\_\_\_\_

P.O. No.: \_\_\_\_\_

Weight: \_\_\_\_\_

Date Rec'd: \_\_\_\_\_

Approval Completed: \_\_\_\_\_

Data Review: Record below any test results not meeting specification.

Disposition:

Accept: \_\_\_\_\_

Reject \_\_\_\_\_ Complete IMR if  
Rejected:

Use Restriction:

Quality Control Engineering: \_\_\_\_\_

Date: \_\_\_\_\_

Paste Engineer: \_\_\_\_\_

Date: \_\_\_\_\_



## RAYTHEON COMPANY

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Operation Standard	1491	
Sheet	18	Rev. 1
Date	April 8, 1975	
Subject	GOLD PASTE SPECIFICATION APPENDIX F	
	POC 75-6081	

Particle Size Distribution:

No particles above 20 microns  
Average particle size must be  
no greater than 15 microns.

Net Weight:

Within 1 gram of P.O. requirement.

General Visual:

O.S. 1265 criteria

Gold Bubbling:

Dielectric Bubbling:

There shall be no evidence of  
bubbling under 30X magnification  
and under 60X magnification.

Resolution:

Fine line gold paste

5-6 mil lines must retain at least  
4 mil spacing.

Other gold pastes

10 mil lines must retain at least  
3 mil spacing.

Resistivity:

.005 ohms/square/mil thickness max.

Beam Lead Attach

Visual

O.S. 1265

Thermo Compression Wire Attach

Visual

Pull Test

O.S. 1265

O.S. 1265

Eutectic Die Attach

Visual

Push Test

O.S. 1265

O.S. 1265

Ultrasonic Wire Attach

Visual

Pull Test

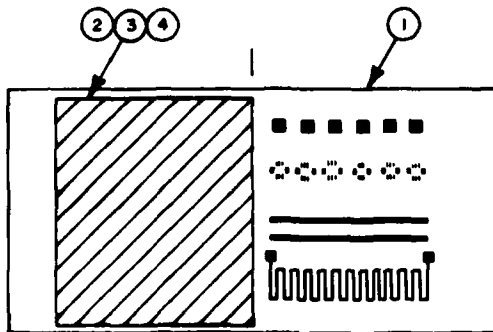
O.S. 1265

O.S. 1265

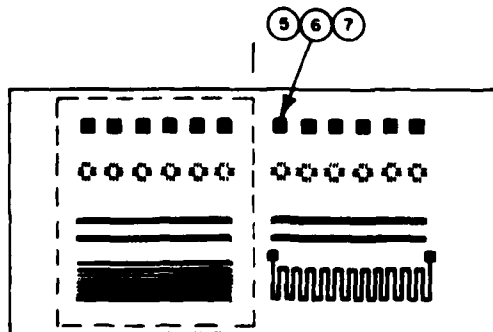
Glass and Metal Segregation

Gold must have metallic luster,  
Under 200-200X magnification, glass  
must not be visible in gold pores.  
Substrates 9 to 12 only.

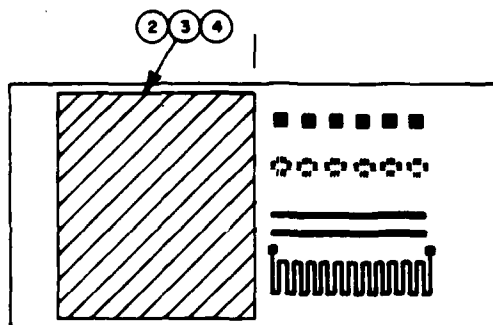
## Appendix J



**SUBSTRATE-SCREENED  
(DIELECTRIC)**



**SUBSTRATE-SCREENED  
(GOLD CONDUCTOR)**




**SUBSTRATE-SCREENED  
(DIELECTRIC)**

ITEM NO.	DESCRIPTION	IDENT. NO.	SPEC. NO.
1	Substrate		26219-49
2	Dielectric Paste	8399	26541-9
3	Dielectric Paste	4608	26596-9
4	Dielectric Paste	9429	
5	Gold Paste	8380	26540-35
6	Gold Paste	9260	26540-37
7	Gold Paste	262	26466-17

## Appendix J

ITEM NO.	DESCRIPTION	IDENT NO	SPEC NO
1	Substrate		26219 - 49
2	Dielectric Paste	8399	26541 - 9
3	Dielectric Paste	4608	26558 - 9
4	Dielectric Paste	9429	
5	Gold Paste	8380	26540 - 35
6	Gold Paste	9260	26540 - 37
7	Gold Paste	282	28466 - 17

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	Date November 30, 1977	
Subject CLEANING OF ARCO MODULES	POC 77-6517	

5.1

# 1.0 PURPOSE:

To remove flux and surface contamination.

## 2.0 MATERIALS:

- 2.1 Freon TP-35 duPont
- 2.2 Isopropyl Alcohol-electronic grade or MOS grade
- 2.3 Glass Beakers
- 2.4 Hot Plate

## 3.0 PROCEDURE:

- \*3.1 Fill appropriate size beaker with clean Freon TP-35.
- 3.2 Completely immerse modules in TP-35 and hold until ready for step 3.3. Allow two minutes from removal from soldering heat columns and immersion.
- 3.3 Remove modules from TP-35. Discard TP-35. Brush with TP-35 to remove any visible contamination.
- 3.4 Reimmerse modules in a clean beaker filled with clean freon TP-35 and boil for a minimum of five minutes.
- 3.5 Remove from heat and let stand five minutes at room temperature. (Note: this step is necessary to avoid thermal shock).
- 3.6 Remove modules from TP-35 and allow excess solvent to stand off.
- 3.7 Immerse modules in clean isopropynol and allow to stand ten minutes at room temperature.
- 3.8 Remove from isopropynol and allow to dry in air.

\*Note: By clean it is ment as received from the vendor and approved by M.I.D.



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501

**1.0 PURPOSE:**

To attach discrete components such as diodes, transistors, capacitors, jumpers and leads to pre-timed substrate.

## 2.0 SAFETY:

Use normal precautions around hot soldering tools.

### 3.0 APPLICABLE DOCUMENTS:

Assembly drawing for each module.

#### 4.0 EQUIPMENT, TOOLS, GAUGES:

- 4.1 Tweezer #3 or equivalent (non-metallic for leadless devices).
- 4.2 Cutters
- 4.3 Flux dispenser EPE Corp. FD-2-1 (.010 dia. needle) or equiv.
- 4.4 Soldering iron as specified in Table I.
- 4.5 Heat column ( $135 \pm 16^{\circ}\text{C}$ ) with vacuum hold down.
- 4.6 Variac for heat column.
- 4.7 Microscope - B & L 7X to 30X Stereozoom or equivalent.
- 4.8 Toothpicks, wooden.

## 5.0 PROCESS REQUIREMENTS:

### 5.1 Materials:

- 5.1.1 Solder - Type WRMAP2 (Alpha Reliacore 11) QQS-571E or WS of Fed. Spec. QQS571E.
  - 5.1.1.1 60% Sn for parts without silver-bearing terminations.
  - 5.1.1.2 62% Sn, 36% Pb, 2% Ag for parts with silver-bearing terminations.

[illegible]



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Subject	REFLOW SOLDERING (USING IRON TO REFLOW)
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## 5.1 Cont.

5.1.1.3 96% sn, 4% Ag when specified on drawing.

5.1.2 Flux - Alpha #611

5.1.3 Flux cleaner - Freon TP35 and Isopropanol.

## 5.2 PROCEDURE:

- 5.2.1 Cut and bend leads of components to fit the conductor pads according to applicable assembly drawing. Leads bends shall have radius of not less than 1.5 times diameter of the wire.
- 5.2.2 Place components ready to assemble in bins or cups next to the substrate heat column.
- 5.2.3 Place substrate on heat column with vacuum hold-down activated. Manipulate heat column so area to be bonded is microscope field.
- 5.2.4 Using tweezers, pick up components, place in position on substrate. Flux from dispenser as necessary. While soldering hold cap in position with toothpick or nonmetallic tweezers.
- 5.2.5 Flow solder onto leads by touching with hot iron. Additional solder may be added where required to achieve a good joint per product requirements.
- 5.2.6 When assembly process is interrupted for more than two minutes, remove substrate from heat column.
- 5.2.7 Heat column temperature to be monitored daily by QC personnel,  $- 135 \pm 16^{\circ}\text{C}$ . Settings for soldering iron to be per Table I. After assembly is completed remove from hot plate and clean substrate with Freon TP35 and a soft brush to remove all traces of flux. Do not dip in Freon or other solvent immediately after soldering unless solvent is heated. Allow substrate to cool to room temperature first.

## 6.0 QUALITY:

6.1 Workmanship Criteria In O.S. 1265.



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TABLE I

PROCESS	*IRON	**IRON TEMP. °C	TOLERANCE $\pm$ °C
Solder Coat Substrates	$\text{1S}^1$	320	10
Solder Pins	$\text{1S}^1$	320	10
Solder Chip Caps.	$\text{1S}^1$	320	10
Solder Tant. Caps.	L	390	20
Solder Switch, Diode	L	400	20
Remove Components	L	400	20
Replace Components	L	400	20
Attach Lead Wires	L	400	20

\* IRON  $\text{1S}^1$ : Weller Station MP 156, Tip MP 131, Soldering Iron MP 126

IRON L: Weller Station WTCPN 500, Tip PT08; (or Plato C-4223-8) Soldering Iron TC201.

\*\* As measure by means of calibrated thermocouple Wahl Thermometer with type K thermocouple and: TC867 Soldering Iron Probe, TC806-A Surface probe and TC801 u immersion probe.

Note 1: If the reading is outside the tolerance the soldering operation should stop until the temperature is corrected.

The readings should be taken once daily and when a new tip of iron is put into operation.

Note 2: The soldering iron tips must be grounded. Grounding checks shall be made by the operators a minimum of every 1/2 hour. Ungrounded or intermittent irons are to be replaced.





### Operation Standard

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Sheet

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Date \_\_\_\_\_

Feb. 12, 1975

**Subject**

## GOLD-PLATINUM PASTE APPROVAL PROCEDURE

POC 75-6022

This procedure details the steps for approval of Gold-Platinum paste used for conductor material on thick film microelectronic substrates.

The procedure provides instruction for all phases of the approval system from receipt of paste to Engineering Review of inspection data. The approval samples are inspected/tested for visual criteria, adhesion and resistivity.

- 3.1 Dip solder process station
- 3.2 Presco Screener
- 3.3 Electrode Screen (Test Pattern) P/N 30409
- 3.4 Watkins Johnson Furnace.
- 3.5 Marking Pencil (Aluminum)
- 3.6 Soldering Iron (17W)
- 3.7 Soldering Iron tip 1/32"
- 3.8 Digital Ohmmeter (6 place)
- 3.9 Wire: 26 AWG Tinned Copper
- 3.10 Clevite Brush Surfanalyzer Model 150
- 3.11 Chatillon Push/Pull Gauge - 10 Lbs capacity.
- 3.12 Microscope 10-30X zoom.
- 3.13 Rotovisco Viscosity Analyzer
- 3.14 Screening Drier
- 3.15 Screen Tension Gage
- 3.16 Spatula

[illegible]



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3.0 EQUIPMENT: Cont.

- 3.17 Wiping cloth (lintless)
- 3.18 Loading trays
- 3.19 Particle Size Analysis Wedge
- 3.20 See also Appendix B

4.0 DOCUMENTATION:

- 4.1 O.S. 1007 - Screening Electrodes
- 4.2 O.S. 1011 - Screener Set-Up Procedure
- 4.3 O.S. 1012 - Firing Schedule Furnace Profile
- 4.4 O.S. 1000 - Substrate Cleanliness Test
- 4.5 O.S. 1034 - Operation of Rotovisco Unit
- 4.6 O.S. 1475 - Particle Size Dist. Analysis of Screenable Pastes
- 4.7 O.S. 1312 - Evaluation of a New Type of Conductor Paste.
- 4.8 O.S. 1452 - Honeywell Substrate Program
- 4.9 MIL-STD-202D
- 4.10 O.S. 1265 - Workmanship Criteria for Microelectronics Programs

5.0 PROCEDURE:5.1 Receipt of Paste From Vendor:

- 5.1.1 No delay shall be allowed in the handling of gold-platinum paste materials from receipt of paste until delivery to Stores. If paste cannot be delivered to Stores through M.I.D. within the time frame of one shift, the paste shall be retained by the Receiving Dept. under lock until the next working shift.
- 5.1.2 The Material Inspection Dept. shall review paste label data for conformance with purchase order requirements.
- 5.1.3 The label data shall be recorded on an appropriate data sheet along with received date, lot no. and issue date to Stores, (See Appendix C).



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## 5.0 PROCEDURE: Cont.

- 5.1.4 If any discrepancies are noted during this examination, the cognizant Quality Control Engineer shall be consulted for disposition of the material.
- 5.1.5 A paste approval data form (Appendices D & E) shall be forwarded with the lot to Stores.
- 5.1.6 Store room personnel shall record pertinent information on inventory records and forward the paste to the "Paste Room" on the same day.
- 5.1.7 Paste room personnel shall record the receipt of the paste and maintain segregation and security of the unapproved material.

## 5.2 Paste Room Sampling and Analysis:

- 5.2.1 The paste room technician shall check and record:

Paste viscosity, net weight, and particle size distribution. Refer specification sheet of Appendix G.

- 5.2.1.1 Paste viscosity shall be checked using the Rotovisco unit according to O.S. 1034
- 5.2.1.2 Net weight of paste shall be measured to the nearest gram. A standard weight for the container and cover shall be assumed.
- 5.2.1.3 Particle size distribution shall be measured in accordance with O.S. 1475.
- 5.2.1.4 If lots are rejectable to net weight and/or particle size distribution criteria, disposition of the lot shall be made prior to continuance of lot approval.

## 5.2.2 Paste Sampling for Paste Approval:

- 5.2.2.1 The paste technician shall mix the paste with a clean spatula for ten minutes.
- 5.2.2.2 Approximately one to two ounces shall be transferred to a 1 fl. ounce plastic jar provided for testing purposes. The weight of the sample shall be recorded in the material usage log book. Paste sample shall be properly identified.
- 5.2.2.3 The paste sample shall be delivered to the paste approval screening technician with the data form of Appendix C.



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5.0 PROCEDURE: Cont.5.3 Screening, Inspection and Testing:

- 5.3.1 All process data must be entered in the lot traveler of Appendix E.
- 5.3.2 Paste Type - Refer flow diagram of Appendix I for applicable paste types.
- 5.3.3 Substrate Test Vehicle - Use (1 x 1) substrate P/N 26219-29.
- 5.3.4 Substrates must be cleaned per O.S. 1000 prior to screening.
- 5.3.5 Marking and Sample Sizes - Mark test and control substrates with an aluminum marker in accordance with the following schedule:
  - 5.3.5.1 Ten test units mark 1 through 10.
  - 5.3.5.2 Five control units mark C1 through C5.
- 5.3.6 Screen Part No. - Use screen (electrode and pull test pattern) Part No. 30409 for all screenings.
- 5.3.7 Special Note - Screening technician should note visual appearance of screened conductors during screening and drying operations to assure a "best effort test".
- 5.3.8 Screen and dry the electrode pattern on substrates 1 through 10 using the gold-platinum paste under test. Paste dried height should be 0.0012 to 0.0020 inches.
- 5.3.9 Within a four hour period of the screening of the test substrates, screen the electrode pattern on substrates C1 through C5 using a fully approved lot of gold-platinum paste of the same type as the paste under test. Paste dried height should be 0.0012 to 0.0020 inches.
- 5.3.10 Subject all test and control units to visual examination in accordance with the criteria of Appendix G.
- 5.3.11 If any screened and dried substrates of paragraph 5.3.10 do not meet the criteria of Appendix G, the cognizant quality control engineer shall be notified in order to initiate any required modification or disposition of the test.



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GOLD-PLATINUM PASTE APPROVAL PROCEDURE			

5.0 PROCEDURE: Cont.

- 5.3.12 Fire all control and test units in random order per Section 5.2 of O.S. 1012.
  - 5.3.13 Submit units 1, 3, 8, C2, C3, and C5 to the Inspection Department for visual examination in accordance with the criteria of Appendix G.
  - 5.3.14 Submit units 1, 3, C2, and C5 for resistivity testing in accordance with the instruction of Appendix A. Record applicable data on the data sheet of Appendix A-1 and the Lot Traveler (Appendix E). Resultant resistivity must meet the requirements of Appendix G.
  - 5.3.15 Solder all test and control substrates in accordance with Appendix B of this Operation Standard.
  - 5.3.16 Submit substrate numbers 2 and C1 to the Inspection Department for evaluation of wetting property. Refer Appendix G for criteria.
  - 5.3.17 Submit all control and test substrates for lead attachment to pull test pads.
    - 5.3.17.1 Attach test leads (1 1/4" x 26 AWG tinned copper wire) to the ten pads of each substrate in accordance with the instruction of O.S. 1312, paragraph 6.3.6.3.
- Note: Solder on test pads should be remelted and rubbed with the tip of a 17 watt iron. The maximum amount of solder should be used when attaching leads and the substrate allowed to cool to room temperature prior to cleaning.
- 5.3.17.2 Care must be exercised in the soldering and handling of pull test wires. Poor techniques will result in low pull test readings.
  - 5.3.17.3 Wire attachments must be performed by the same operator during one operating shift.
  - 5.3.17.4 After soldering excess flux should be removed using Chlorothene V.G.; Genesolv DTA, Isopropanol.
  - 5.3.17.5 Substrates with attached wires must be allowed to remain at room ambient conditions prior to pull testing for a minimum of twenty-four hours.



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5.0 PROCEDURE: Cont.

- 5.3.18 Pull test one half of the test leads on all substrates in accordance with the instruction of O.S. 1452 paragraphs 7.3.1 through 7.3.6. Record the results of pull testing on the data sheet of Appendix F. The pad adhesion must meet the requirements of Appendix G.
- 5.3.19 Subject all the substrates to 30 cycles of temperature cycling per MIL-STD-202D, Method 107, Condition B-3. Exception - the low temperature shall be  $-55^{\circ}\text{C} + 3^{\circ}\text{C}$  and the time at temperature shall be 30 minutes\*. After removal from the chamber, the substrates shall be allowed to air stabilize for four hours minimum. \*This should provide for substrate to be at temperature for 10 minutes.
- 5.3.20 Pull test the remaining half of the substrates as in paragraph 5.3.18.
- 5.3.21 The pull test inspector shall record the failure mode of all test pads which do not meet the minimum pull test requirement.
- 5.3.22 Typical Failure:
- 5.3.22.1 Test lead breaks.
  - 5.3.22.2 Test lead pulls away from solder.
  - 5.3.22.3 Solder pads separates from conductor.
  - 5.3.22.4 Conductor separates from the substrates.
  - 5.3.22.5 Conductor pad is completely or partially removed with some ceramic adhering.
  - 5.3.22.6 Note: Items 5.3.22.1; 5.3.22.2 are not used to determine Acceptance or Failure

6.0 ENGINEERING REVIEW AND DISPOSITION:

- 6.1 The cognizant Quality Control and Screening Engineers shall review all approval data and provide disposition on the approval form of Appendix D. Any use restrictions shall be noted on the form.
- 6.2 Copies of the approval and data forms shall be forwarded to M.I.D.; the Paste Room technician and the cognizant Screening Room Engineer. If restrictions are noted on the approval form an extra copy shall be forwarded to M.I.D. A copy of the approval form only shall be forwarded to Production Control.



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6.0 ENGINEERING REVIEW AND DISPOSITION:

- 6.3 Upon receipt of an approved form, the M.I.D. inspector shall label the subject paste jar with either an accept or reject notation. If a restriction is noted on the approval form, a notation on the jar shall be placed with the words "Restricted Use". A copy of the approval form shall also be provided by M.I.D. and placed with the subject jar, if the jar has a use restriction.
- 6.4 Rejected jars shall be placed in a special "Reject Drawer" until appropriate disposition of the rejected jar is made.



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Subject	GOLD-PLATINUM PASTE RESISTIVITY TEST PROCEDURE APPENDIX A	
	POC 75-6022	

- 1.0 Using a six place digital multimeter check resistance of resistivity run on test substrate. (Use four point probe).
- 2.0 Using the Brush Surface Analyzer check the height of the resistivity run in five places.
- 3.0 Determine an average of the five height readings of 3.0 above by adding the five readings and dividing by 5.
- 4.0 Multiply the average height reading in mils (reading in inches times one thousand) times the resistance of the resistivity run from "1" above.
- 5.0 Divide the results of "4" above by 371.5 which is the number of squares of the resistivity run. This net result is the resistivity of the paste.
- 6.0 Record the results of "5" above for each substrate on Appendix A-1 and Appendix C or D.
- 7.0 Formula -

$$R \times \frac{(h1 + h2 + h3 + h4 + h5)}{5} = \text{Resistivity}$$

371.5

R = Resistance reading of run.

h, etc. = height reading in mils  
(Record readings on Appendix A-1)



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GOLD-PLATINUM CONDUCTOR PASTE  
RESISTIVITY CALCULATION APPENDIX A-1

POC 75-6022

(A) Sub. No.	(B) Net Resistance	(C) 1	(D) 2	(E) 3	(F) 4	(G) 5	(H) Height Total	(I) Avg. Height
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								

(Place readings adjacent to appropriate substrate no.

(C,D,E,F,G = Height Readings in mils.

Avg. Hgt = Height Total - 5

Resistivity =  $\frac{BI}{371.5}$ 

Result:

Sub. No.	Resistivity
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	



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Subject	DIP DOLDERING OF CONDUCTORS APPENDIX B	
		POC 75-6022

1.0 PURPOSE:

This document provides instruction for dip soldering of conductors on ceramic substrates.

2.0 SAFETY:

2.1 Molten solder is hazardous - Safety glasses must be worn and caution exercised to prevent burns.

3.0 DOCUMENTS:

3.1 Operating and Maintenance Manual No. 1873JA- Electrovert, Inc.

3.2 MIL-S-6872A General Specification for Soldering Processes.

4.0 EQUIPMENT:

4.1 Wave Dipper - Electrovert, Model No. WDC - or equivalent.

4.2 Thermometer.

4.3 Glass beakers

4.4 Exhaust system

4.5 Holding fixtures.

4.6 Infrared heat source.

5.0 START-UP PROCEDURE:

5.1 Turn "heater-switch" on.  
Do not turn motor switch on.

5.2 Set temperature pointer to 236°C.

5.3 Add enough "Planter Peanut Oil" (Commercial Grade), or Kenco Wave Oil No. 580 to completely cover the solder.

5.4 When solder has reached a temperature of 230°C, turn the motor switch on.



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## 6.0 MATERIALS - SOLDER COATING:

- 6.1 Solder - P/N 28093-69  
Flux - 28093-87  
Post Solder  
Cleaning Solv - Genesolv DTA, P/N 26552-22 or equivalent.

## 7.0 GENERAL PROCEDURE:

- 7.1 Clean substrate conductor pattern using Eberhard Faber No. 102 typewriter eraser. Operator must wear finger cots. Vigorously rub the eraser in length and width directions. Use approximately 10 strokes in each direction making sure to rub all test pad surfaces. The cleaned surface should be uniformly bright and free of all particles. Note: Cleaned substrates must be solder dipped within 4 hours.
- 7.2 When the solder temperature has reached  $236^{\circ}\text{C} \pm 3^{\circ}\text{C}$  the solder dipping process may commence.
- 7.3 Completely immerse the substrate in flux for  $15 \pm 2$  seconds.
- 7.4 After removing the substrate from the flux preheat the substrate by placing it on a perforated stainless steel rack which rests over the non-active area of the molten solder. The time of preheat shall be  $1 \pm 3$  seconds.
- 7.5 Using a suitable holding fixture or tong, grip the substrate at diagonal corners and completely immerse the substrate into the solder wave at a solder to substrate angle of approximately  $60^{\circ}$ . The electrode pattern must be in the up position. The time of immersion shall be 3 to 5 seconds.
- 7.6 After removing the substrate from the solder, immediately place it under an infra-red or heat lamp heating source which provides a  $125^{\circ}\text{C}$  ambient. The time of this application shall be a minimum of ten minutes.
- 7.7 Remove substrate from heat source and allow to cool to room temperature.
- 7.8 Place substrate into post-soldering cleaning medium.
- 7.9 Remove from cleaning medium and clean in ultrasonic degreaser for one minute.
- 7.10 Record work performed in the log book at the solder station. Note: If log indicates greater than 10,000 "dips" before last last solder change notify cognizant Quality Control Engineer.



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8.0 GENERAL:

- 8.1 Remove burned oil dross and maintain adequate oil level. Completely replenish oil at a frequency recommended by the manufacturer.
- 8.2 Maintain the solder level at a level no lower than 3/8 inch below the rim of the pot as measured when the solder is in a solid condition.



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Subject	PASTE RECEIVAL AND RECORD FILE (MID FORM) APPENDIX C
	POC 75-6022 C.S. 2-1-75

Date Received: \_\_\_\_\_

Date Approved/Rejected: \_\_\_\_\_

Part No.: \_\_\_\_\_

Paste Name: \_\_\_\_\_

MID Lot No.: \_\_\_\_\_

Vendor: \_\_\_\_\_

P.O. No.: \_\_\_\_\_

Vendor Lot No.: \_\_\_\_\_

Vendor P/N \_\_\_\_\_

Weight per jar from label: \_\_\_\_\_

Other Label Data \_\_\_\_\_

Accepted:

☐

Rejected:

☐

Restrictions - List Below:


Reason for Rejection and Disposition:




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Subject	ENGINEERING APPROVAL VERIFICATION APPENDIX D	
	POC 75-6022	

Paste Type No.: \_\_\_\_\_

MID Lot No.: \_\_\_\_\_

Jar No.: \_\_\_\_\_

Vendor: \_\_\_\_\_

Vendor Lot No.: \_\_\_\_\_

P.O. No.: \_\_\_\_\_

Weight: \_\_\_\_\_

Date Rec'd: \_\_\_\_\_

Approval Completed: \_\_\_\_\_

Data Review: Record below any test results not meeting specification.

Disposition:

Accept: \_\_\_\_\_

Reject \_\_\_\_\_ Complete IMR if rejected:

Use Restriction:

Quality Control Engineering: \_\_\_\_\_ Date: \_\_\_\_\_

Paste Engineer: \_\_\_\_\_ Date: \_\_\_\_\_

GOLD-PLATINUM PASTE APPROVAL ROUTE AND DATA SHEET

Jar No. \_\_\_\_\_

Control Paste Lot No. \_\_\_\_\_

Test Vehicle-Substrate No. 26219-29

Control Paste Jar No. \_\_\_\_\_

Paste No. Under Test \_\_\_\_\_

Screen Part No. 30409

Vendor \_\_\_\_\_

P.O. No. \_\_\_\_\_

Viscosity as Rec'd \_\_\_\_\_

Vendor Lot No. \_\_\_\_\_

Date Rec'd \_\_\_\_\_

Viscosity Adjusted  
to Particle Size \_\_\_\_\_

M.I.D. Lot No. \_\_\_\_\_

Paste Weight \_\_\_\_\_

Distribution \_\_\_\_\_

Op. No.	Oper. Name	O.S. No.	No. Pcs.	Oper/ Insp.		Mach. No.	Data
				In	Out		
1	Mark Substrates (Test and Control)		15				
2	Screen Substrates - Test Pcs. 1-10	1007	10				
3	Screen Substrates Control C1-C5	1007	5				
4	Visual Inspection App. (Production) Test & Control		15				
5	Fire all Units	1012	15				
6	Inspect App. G 1, 3, 8, C2, C3, C5		6				
7	Resistivity Test App. A Nos. 1, 3, C2, C5 7a. Check Resistance 7b. Check Height		4				
8	Burnish and Dip Solder App. B		15				

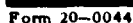
Record Final Values on  
App. A-1 and here  
Item (7) \_\_\_\_\_ C2  
1 \_\_\_\_\_  
3 \_\_\_\_\_ C5

GOLD-PLATINUM APPROVAL ROUTE AND DATA SHEET

M.I.D. Lot No. \_\_\_\_\_

Op. No.	Oper. Name	O.S. No.	No. Pcs.	Date		Oper/ Insp.	Mach. No.	Data
				In	Out			
9	Inspect for Wetting Subs. No. 2 and C1		2					
10	Attach Test Leads	1312	15					
11	Pull Test Half of Test Pads	1452	15					
12	Temp. Cycle 30 Cycles -55°C to +125°C		15					
13	Pull Test Remaining Pads	1452	15					
14	Eng. and Q.C. Eng. Review							





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## PULL TEST DATA SHEET

1. With both resistivity test pads to the left the pull test pads are designated one to ten. Starting at the top left going counter-clockwise and ending at the top right.
2. When designating pads for pre-temp and post-temp pulls, use random selections. However, use same pad selections for every substrate.

[illegible][illegible]



RAYTHEON COMPANY

Form 20-0044

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Subject  
GOLD-PLATINUM PASTE APPROVAL PROCEDURE

## APPENDIX G

Particle Size  
DistributionOnly 2 particles allowed between  
20 to 25 microns. No particles  
allowed above 25 microns.

Net Weight

Within one gram of P.O. requirement

General Visual

O.S. 1265 Criteria

Paste Spreading

Resistivity pattern width must not  
be increased more than 0.004 inches  
in any area.Fired Height  
Resistivity0.0006 to 0.0012 inches  
0.06 ohms per square maximumConductor Solder  
Wetting

98% Solder coverage minimum

Adhesion - Pre Temp  
Cycle2.2 pounds median minimum.  
Only 2 pads will be allowed to  
pull less than 1.6 pounds.Adhesion - Post Temp  
Cycle (30 cycles)1.8 pounds median minimum  
Only 2 pads will be allowed to  
pull less than 1.4 pounds.



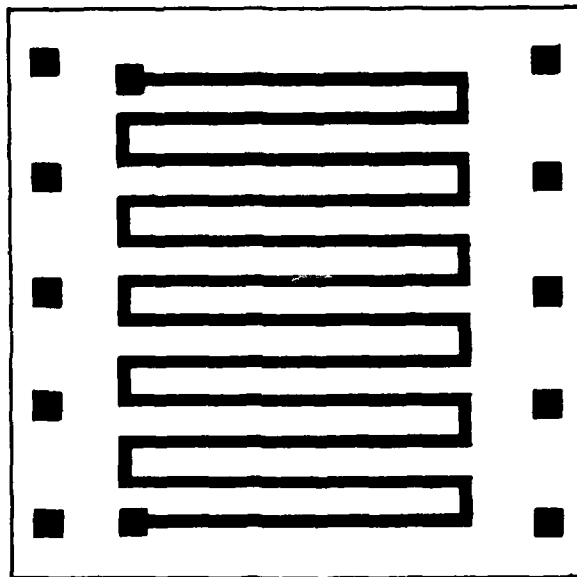
RAYTHEON COMPANY

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	POC 75-6022 C. C. 2	

APPENDIX H

Substrate With Screened Pattern



Substrate P/N 26219-29

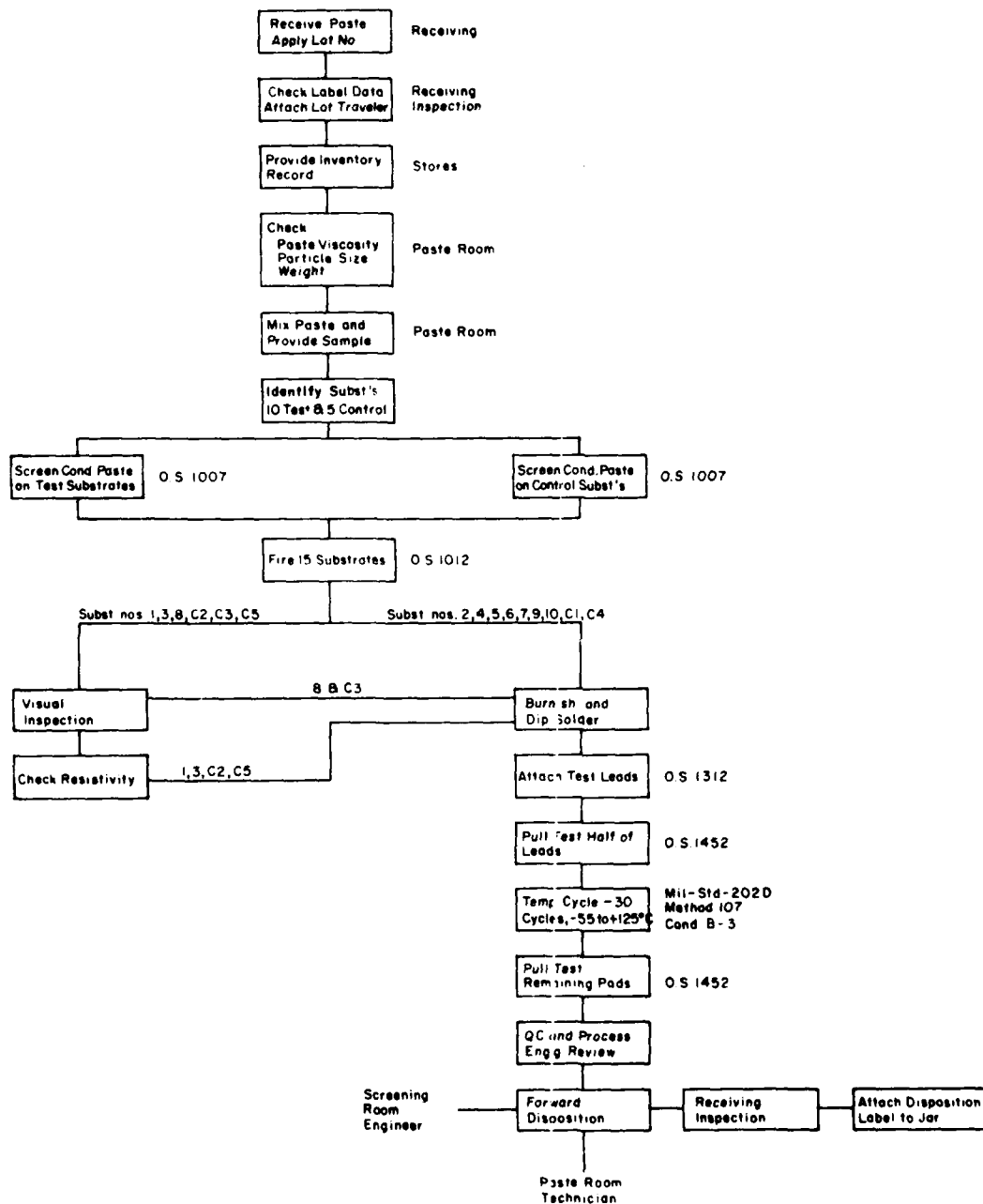
Screen P/N 30409

# PLATINUM-GOLD PASTE APPROVAL

OPERATION  
STANDARD 1498

Sheet 20, Rev 0  
Date: Feb 27, 1975

## Appendix I



### Notes

1. Total sample - 15 substrates
2. Use Screen 30409
3. Use Substrate 26219-29

Paste Type	Dwg No	Firing Temp	Belt Speed
C6010	26205-3	950°C	8"/min
C6010C	26208-39	950°C	8"/min



Form 20-0044

## RAYTHEON COMPANY

Operation Standard		1500
Sheet	1	Rev. 1
Date March 19, 1976		
POC 76-6063		

## 1.0 Purpose

This procedure details the steps for approval of resistor paste used on thick film microelectronic substrates.

## 2.0 Scope

This procedure provides instruction for the handling, processing, and testing of resistor paste material from the time of receipt to final evaluation and disposition. Tests include particle size distribution, resistivity, interface resistivity, TCR and visual criteria.

### 3.0 Documents

Drawing No. 29468

- O.S. 1005 - Resistor Paste Approval
- O.S. 1007 - Electrode Screening
- O.S. 1008 - Screening Resistors
- O.S. 1009 - Resistor Firing
- O.S. 1012 - Firing Profiles, Characteristics, Freq.
- O.S. 1039 - Temp. Coefficient Test Procedure
- O.S. 1450 - Qual. Procedure for the Honeywell Substrate Program
- O.S. 1475 - Particle Size Distribution
- O.S. 1487 - Res. Paste Static Electricity Shift

#### 4.0 Equipment, Tooling, Gauges

- 4.1 Prescco Screener or equivalent
- 4.2 Set of screens 29469, 29470
- 4.3 Conveyor dryer 110 - 120°C
- 4.4 W. J. resistor furnace
- 4.5 W. J. conductor furnace
- 4.6 Hewlett Packard 3440A digital voltmeter
- 4.7 Substrate marking pencil
- 4.8 Surfanalyzer
- 4.9 3KV Power Supply
- 4.10 Test box for static charge shift test
- 4.11 Stereo zoom microscope 10X - 30X with backlighting capability

[illegible]



RAYTHEON COMPANY

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## 5.0 Procedure

### 5.1 Receipt of Paste from Vendor

- 5.1.1 NO delay shall be allowed in the handling of gold paste materials from receipt of paste until delivery to Stores.
- 5.1.2 The Material Inspection Dept. shall review paste label data for conformance with purchase order requirements.
- 5.1.3 The label data shall be recorded on an appropriate data sheet along with received date, lot no. and issue date to Stores. (See Appendix B)
- 5.1.4 If any discrepancies are noted during this examination, the cognizant Quality Control Engineer shall be consulted for disposition of the material.
- 5.1.5 A paste approval data form (Appendix D) shall be forwarded with the lot to Stores.
- 5.1.6 Store room personnel shall record pertinent information on inventory records and forward the paste to the "Paste Room" on the same day.
- 5.1.7 Paste room personnel shall record the receipt of the paste and maintain segregation and security of the unapproved material.

### 5.2 Paste Room Sampling and Analysis

- 5.2.1 The paste room technician shall check and record:  
paste viscosity, net weight and particle size distribution.  
Refer specification sheet of Appendix G.
  - 5.2.1.1 Paste viscosity shall be checked using the Roto-Visco Unit according to O.S. 1034.
  - 5.2.1.2 Net weight of paste shall be measured to the nearest gram. A standard weight for the container and cover shall be assumed.
  - 5.2.1.3 Particle size distribution shall be measured in accordance with O.S. 1475.
  - 5.2.1.4 If lots are rejectable to net weight and/or particle size distribution criteria, disposition of the lot shall be made prior to continuance of lot approval.



RAYTHEON COMPANY

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## 5.0 Cont.

## 5.2.2 Paste Sampling for Paste Approval:

5.2.2.1 The paste technician shall mix the paste with a clean spatula for ten minutes.

5.2.2.2 Approximately one to two ounces shall be transferred to a 1 fl. ounce plastic jar provided for testing purposes. The weight of the sample shall be recorded in the material usage log book. Paste sample shall be properly identified.

5.2.2.3 The paste sample shall be delivered to the paste approval screening technician with the data form of Appendix D.

## 5.3 Screening of Sample Substrates

NOTE: All process and test/inspection data must be recorded on the traveller. Appendix

## 5.3.1 Paste Types

5.3.1.1 Refer to flow diagram of Appendix for applicable paste types.

5.3.2 Substrate Test Vehicle - Use substrate P/N 26219-29.

5.3.3 Clean substrates per O.S. 1000.

5.3.4 Marking - Using an aluminum marker identify the reverse side of each substrate with the numbers "1"; "2"; and "3".

5.3.5 Conductor Screening - Using a fully approved C6010 conductor material (P/N28205-30r 39) screen the pattern of screen No. 29469 on the three substrates. (Refer O.S. 1007)

5.3.6 Fire the 3 substrates per O.S. 1012. The fired height must be between .0006" to .0012".

5.3.7 Screen the resistor paste under test using screen no. 29470. Refer O.S. 1008

5.3.8 Fire the screened substrates per O.S. 1009  
The fired resistor height must be between .006" to .0012".

5.3.9 Deliver the three samples and documentation to the inspection department.



RAYTHEON COMPANY

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5.0 Cont.

5.4 Testing/Inspection of Samples - Refer specification sheet of Appendix

5.4.1 Inspection/Testing Categories

5.4.1.1 Visual inspection of resistor and resistor interface areas.

5.4.1.2 Paste resistivity

5.4.1.3 Interface resistivity

5.4.1.4 Static charge test (when required). (See Par. 5.4.4.3)

5.4.1.5 Temperature coefficient of resistance (when required) (See Par. 5.4.4.3)

5.4.2 Visual Inspection - The inspector shall examine the screened resistor and resistor-conductor interface areas to the criteria of O.S. 1265.

5.4.3 The inspector shall measure the resistivity and interface resistance ( $R_t$ ) on the three substrates. The instruction for this test is found on Appendix A. Data shall be recorded on Appendix A-1 and the lot traveller.

5.4.4 The cognizant quality control engineer shall determine if either T.C.R. testing or static charge testing is applicable to the test lot.

5.4.4.1 Both tests should not be run on the same lot.

5.4.4.2 The lot may be released (accepted) prior to the completion of either test.

5.4.4.3 Each of the above tests should be run on an annual basis for each manufacturers paste type and resistivity designation.

5.4.5 When applicable the inspector shall forward the 3 piece sample to Production to have test leads soldered to each terminal. The units shall then be forwarded to Receiving Inspection for T.C.R. testing.

5.4.5.1 T.C.R. testing shall be performed in accordance with O.S. 1450 except that trimming and temperature cycling will not be performed. Also  $-15^{\circ}\text{C}$  and  $+65^{\circ}\text{C}$  testing will not be performed.

5.4.5.2 All T.C.R. data will be recorded on the data sheet of O.S. 1450 Appendix B-1. The completed data sheet shall be attached to the lot traveller.





RAYTHEON COMPANY

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## 5.0 Cont.

- 5.4.6 When applicable, the inspector will test the sample for static voltage application in accordance with O.S. 1487. The data will be recorded on Appendix C.

## 5.5 Engineering Review and Disposition

- 5.5.1 The cognizant Quality Control and Screening Engineers shall review all approval data and provide disposition on the approval form of Appendix E. Any use restrictions shall be noted on the form.
- 5.5.2 Copies of the approval and data forms shall be forwarded to M.I.D.; the Paste Room technician, and the cognizant Screening Room Engineer. If restrictions are noted on the approval form an extra copy shall be forwarded to M.I.D. A copy of the approval form only shall be forwarded to Production Control.
- 5.5.3 Upon receipt of an approved form, the M.I.D. inspector shall label the subject paste jar with either an accept or reject notation. If a restriction is noted on the approval form, a notation on the jar shall be placed with the words "Restricted - Use". A copy of the approval form shall also be provided by M.I.D. and placed with the subject jar, if the jar has a use restriction.
- 5.5.4 Rejected jars shall be placed in a special "Reject Drawer" until appropriate disposition of the rejected jar is made.



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RAYTHEON COMPANY

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	POC 75-6103	

## APPENDIX A

## Resistivity Test Procedure

- 1.0 This Appendix provides instruction for the determination of resistivity and interface resistance ( $R_t$ ).
- 2.0 Note: A total of 30 height readings and 30 resistance readings will be taken. Each of the 3 substrates contains 5 "1" square and 5 - "2" square resistors.
- 3.0 Using a six place digital multimeter, check the resistance of each resistor and record results on the data sheet of Appendix A-1.
- 4.0 Using the Brush Surf Analyzer check the height of each resistor and record results on the data sheet of Appendix A-1.
- 5.0 Multiply each height reading in mils (reading in inches times 1000) times its respective resistance reading in ohms. Record this calculation on the data sheet of Appendix A-1.
- 6.0 Add the calculated results from paragraph 5.0 for "1" square resistors and "2" square resistors. Record these two totals on the data sheet of Appendix A-1. As a matter of convenience the total of "1" square resistor calculations shall be called "B"; and the total of "2" square resistor calculations shall be called "A".
- 7.0 Resistivity can now be calculated using the formula.

$$\text{Resistivity} = \frac{A}{15} - \frac{B}{15} \quad (\text{answer is in ohms/square})$$

Record results on data sheet.

- 8.0  $R_t$  can now be calculated using the formula.

$$R_t = \frac{B}{15} - \text{Resistivity} \quad (\text{answer in ohms})$$

Record results on data sheet



RAYTHEON COMPANY

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## APPENDIX G

## RESISTOR PASTE APPROVAL PROCEDURE

PROCESS REQUIREMENTS

	Conductor Paste C6010	Resistor Paste 1 EMCA "PIRON"	Resistor Paste 2 DuPont Birox 1000
Viscosity	23-32	24-32	24-52
Dry Heights	1.2-2.0 mils	1.1-1.6 mils	1.1-1.4 mils
Fired Heights	0.7-1.2 mils	0.6-1.2 mils	0.6-1.2 mils
Drying	120°C±5°-14± 1 min.	120°C±5°-14± 1 min.	120°C±5°-14± 1 min.
Firing	950°C at 8"/min.	1000°C at 2"/min.	850°C at 2 <sup>h</sup> /min.

Resistivity		Nom. Value +0 - 40%	Nom. Value +0 - 40%
Static Elec. Shift		5% Max.	5% Max.
Temp. Coef. of Res.		See Sheet 14A	Info. Only
Particle Size Distribution		Inform. Only	Inform. Only
Visual		O.S. 1265	O.S. 1265



RAYTHEON COMPANY

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	POC 76-6063 C.C. 2/13/76	

Appendix G-1

## T.C.R. Limits

Material Type	Nominal Resistance Value in Ohms per Square	Limits in parts per Million/°C	
		From	To
EMCA FIRON	1	+300	+400
" "	3	+100	+300
" "	10 to 30	-150	+150
" "	100 to 300	-135	+135
" "	1K to 10K	-125	+125
" "	30K	-150	+50
" "	100K	-150	-25
" "	300K	-280	-100
" "	1 Meg.	-550	-350
" "	10 Meg.	-800	-600



RAYTHEON COMPANY  
INDUSTRIAL COMPONENTS DIVISION

Form 28-0044

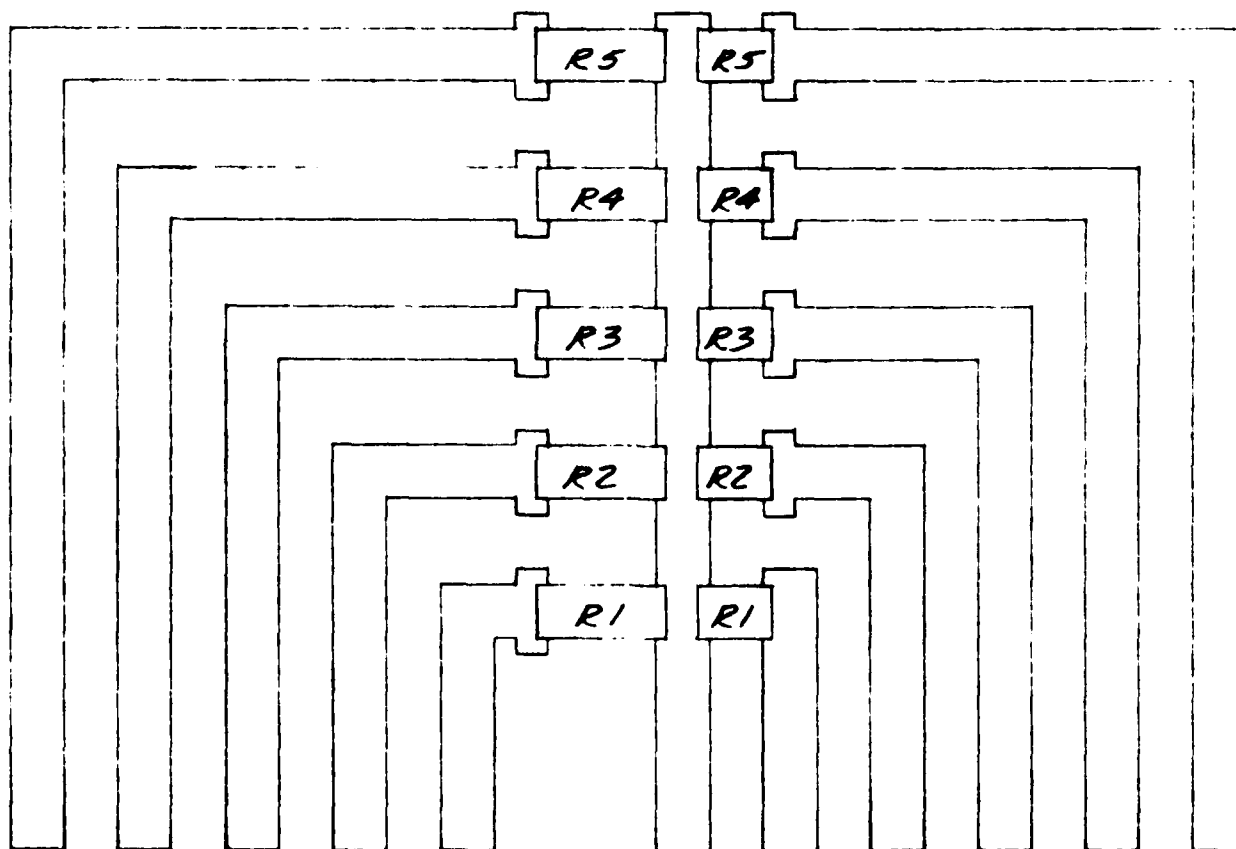
Quantity	1500	
Lot	15	Rev. 0
Date	5/8/75	
Subject	POC 75-6103	

APPENDIX H

Subject

RESISTOR PASTE APPROVAL PROCEDURE

2 SQ. 1 SQ.





RAYTHEON COMPANY

Form 20-0044

### Operation Standard

1506

Sheet 1

Rev. 2

Date May 15, 1979

**Subject**

## DIELECTRIC AND CROSSOVER GLAZE PASTE APPROVAL PROCEDURE

POC 79-6417

## 1.0 PURPOSE:

This procedure details the steps for approval of dielectric (multilayer) and crossover glaze materials used on thick-film microelectronic substrates.

## 2.0 SCOPE:

This procedure provides instruction for all phases of the approval system form receipt of paste to engineering and quality engineering review of inspection data. The approval samples are inspected/tested for the following:

- 2.1 Visual criteria (bubbling, voids, spreading)
- 2.2 Dielectric to substrate and conductor to dielectric adhesion
- 2.3 Resistance shift of conductor
- 2.4 Dielectric resistance
- 2.5 Dielectric porosity (O.S. 1622)

### 3.0 EQUIPMENT:

- 3.1 Refer to referenced screening and firing standards for applicable equipment.
- 3.2 Screen Nos. 30568, 30569, 30570
- 3.3 Stereozoom microscope (30X) with backlighting
- 3.4 Digital Ohm-meter
- 3.5 D.C. power supply with greater than 50V capacity

[illegible]



RAYTHEON COMPANY

Form 10-10044

Operation Standard	1506
Sheet 2	Rev. 1
Date	September 20, 1977
Subject	POC 77-6344

DIELECTRIC AND CROSSOVER GLAZE  
PASTE APPROVAL PROCEDURE

3.0 EQUIPMENT: Cont.

- 3.6 Particle size analysis wedge.
- 3.7 Diamond scribe (Phono-point diamond tip).
- 3.8 Rotovisco viscosity analyzer.

4.0 DOCUMENTATION:

See referenced specifications.

5.0 PROCEDURE:

5.1 Receipt of paste from vendor:

- 5.1.1 The Material Inspection Dept. shall review paste label data for conformance with purchase order requirements.
- 5.1.2 The label data shall be recorded on an appropriate data sheet along with received date, lot no. and issue date to Stores. (See Appendix B)
- 5.1.3 If any discrepancies are noted during this examination, the cognizant Quality Control Engineer shall be consulted for disposition of the material.
- 5.1.4 A paste approval data form (Appendices C & C) shall be forwarded with the lot to Stores.
- 5.1.5 Store room personnel shall record pertinent information on inventory records and forward the paste to the "Paste Room" on the same day.
- 5.1.6 Paste room personnel shall record the receipt of the paste and maintain segregation and security of unapproved material.



RAYTHEON COMPANY

Form 10-10014

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Subject		POC 77-6344

5.0 PROCEDURE: Cont.5.2 Paste Room Sampling and Analysis:

5.2.1 The paste room technician shall check and record: paste viscosity, net weight, and particle size distribution. Refer specification sheet of Appendix G.

5.2.1.1 Paste viscosity shall be checked using the Roto-Visco Unit according to O.S. 1034.

5.2.1.2 Net weight of paste shall be measured to the nearest gram. A standard weight for the container and cover shall be assumed.

5.2.1.3 Particle size distribution shall be measured in accordance with O.S. 1475.

5.2.1.4 If lots are rejectable to net weight and/or particle size distribution criteria, disposition of the lot shall be made prior to continuance of lot approval.

5.2.2 Paste Sampling for Paste Approval:

5.2.2.1 The paste technician shall mix the paste with a clean spatula for ten minutes.

5.2.2.2 Approximately one to two ounces shall be transferred to a 1 fl. ounce plastic jar provided for testing purposes. The weight of the sample shall be recorded in the material usage log book. Paste sample shall be properly identified.





RAYTHEON COMPANY

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DIELECTRIC AND CROSSOVER GLAZE  
PASTE APPROVAL PROCEDURE

POC 77-6344

5.0 PROCEDURE: Cont.

- 5.2.2.3 The paste sample shall be delivered to the paste approval screening technician with the data forms of Appendices C, D and E.
- 5.2.2.4 During the mixing procedure or at any other stage of paste sampling, the technician shall assure that no visible contamination is present. If contamination is found the test shall be stopped and the cognizant Q.C. Engineer notified.

5.3 Screening and Inspection Procedure For Dielectric Used In Multilayered Substrates.

NOTE: Referenced O.S.'s pertaining to screening, drying, and firing are for reference only. Schedules with respect to temperature and speed as found on the flow diagram will supersede.

- 5.3.1 Clean sixteen (16) substrates per O.S. 1000. Use substrate P/N 26219-29.
- 5.3.2 Mark eight (8) substrates with numbers 1 to 8 and 8 substrates with numbers C1 to C8.
- 5.3.3 Using the dielectric under test, screen substrates 1 through 8 using screen number 30568. Refer O.S. 1010.
- 5.3.4 Allow the screened substrates to dry at room ambient conditions for 10 minutes.



RAYTHEON COMPANY

Form 70-0011

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5.0 PROCEDURE: Cont.

- 5.3.5 Radiant dry the screened substrates using the belt dryer. Refer flow diagram. (Appendix H-2)
- 5.3.6 Fire the test samples in accordance with the flow diagram of Appendix H-2. (Refer O.S. 1010).
- 5.3.7 Under 30X magnification using a stereozoom microscope with backlighting, check for visual and dimensional criteria per Appendix G. The microscope should contain a reticule for dimensional inspection.
- 5.3.8 Rescreen the pattern of P/N 30568 and follow the steps of paragraph 5.3.3 through 5.3.5. (Screening through Radiant Drying).
- 5.3.9 Perform dimensional check only as in paragraph 5.3.7.
- 5.3.10 Fire the test samples in accordance with the flow diagram of Appendix H-2. (Refer O.S. 1010).
- 5.3.11 Under 30X magnification, using a stereozoom microscope with backlighting, check for visual and dimensional criteria per Appendix G. The microscope should contain a reticule for dimensional inspection.
- 5.3.11.1 Remove six (6) substrates (6,7,8 and C6,C7, C8) for dye check of porosity per O.S. 1622. Record results in the data column of the routing sheet. (App.D)



RAYTHEON COMPANY

Form 70-6044

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5.0 PROCEDURE: Cont.

5.3.12 Using a previously approved dielectric paste of the same type as the paste under test, perform all screening drying, firing and inspection operations on substrates C1-C8 (Control) following the instructions of paragraphs 5.3.3 through 5.3.11 inclusive.

5.3.13 Screen and dry the applicable gold conductor material on ten (10) substrates (1-5 and C1-C5) using screen No. 30569.

NOTE: The gold screened conductor must be allowed to air dry for fifteen (15) minutes at room ambient conditions prior to radiant (belt) drying. Refer pictorial of Appendix F-2.

5.3.14 Fire all ten (10) substrates per the schedule on the flow diagram of appendix H-2. (References: O.S. 1007 and 1012).

5.3.15 Inspect visually for bubbling and voids on the electrode surface in accordance with the specification of Appendix G. (10 substrates)

5.3.16 Fire substrates 1,2, C1 and C2 thirteen (13) times per the schedules on the flow chart of Appendix H-2.

5.3.17 Check substrates 1,2, C1 and C2 for bubbling and voids as in paragraph 5.3.15.

5.3.18 Check substrates 1,2, C1 and C2 for conductor and dielectric adhesion in accordance with the instruction of Appendix A and the specification of Appendix G.



RAYTHEON COMPANY

Form 20-0034

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Subject DIELECTRIC AND CROSSOVER GLAZE PASTE APPROVAL PROCEDURE	
POC 77-6344	

5.0 PROCEDURE: Cont.

- 5.3.19 Seal substrates 1,2, C1 and C2 in an envelope and attach to the lot traveler.
- 5.3.20 Check substrates 3,4,5,C3,C4, C5, for electrode resistance. Record data on Appendix E.
- 5.3.21 Rescreen test dielectric on substrates 3,4,5 and the control dielectric on substrates C3,C4 and C5, using screen no. 30568. Follow the instructions of paragraphs 5.3.3 through 5.3.12 inclusive except that no dimensional inspections will be made.

PLEASE NOTE:

After these screenings, the six (6) substrates should have two (2) dielectric screenings; one gold screening followed by two (2) dielectric screenings.

- 5.3.22 Check substrates 3,4,5,C3,C4, and C5 for electrode resistance. Record data on Appendix E. Determine percent resistance shift for each substrate.
- 5.3.23 Screen and dry the second electrode using the applicable gold paste and screen P/N 30570 on the six (6) substrates.

NOTE: Gold screened conductor must be allowed to air dry for fifteen (15) minutes at room ambient conditions prior to radiant (belt) drying. Refer pictorial of Appendix F-4, Reference O.S. 1007.

# DIELECTRIC AND CROSSOVER GLAZE APPROVAL ROUTE AND DATA SHEET

O.S. 1506  
Page 16  
App. D

Rev. 2

Jar No.:

Conductor Paste Type: \_\_\_\_\_

Conductor Paste Lot No.: \_\_\_\_\_ Jar No.: \_\_\_\_\_

Control Paste Lot No.: \_\_\_\_\_

Control Paste Jar No.: \_\_\_\_\_

Test Vehicle Substrate No.: 26219-29

Paste No. Under Test: \_\_\_\_\_

Vendor: \_\_\_\_\_

Vendor Lot No.: \_\_\_\_\_

M.I.D. Lot No.: \_\_\_\_\_

P.O. No.: \_\_\_\_\_ Viscosity as Rec'd: \_\_\_\_\_

Date Rec'd: \_\_\_\_\_ Particle Size: \_\_\_\_\_

Paste Weight: \_\_\_\_\_ Distribution: \_\_\_\_\_

Op. No.	Operation Name	D.S. No.	Screen No.	No. Pcs.	Date		Oper/ Insp. No.	Mach. No.	Data
					In	Out			
1.	Clean Substrates	1000		16					Note 1: See Appendix H-2 for all drying and firing schedules
2.	Mark Substrates			16					
3.	Screen Test Dielectric	1016	30568	8					
4.	Room Temp. Dry			8					
5.	Radiant Dry			8					
6.	Fire Substrates	1016		8					
7.	Vis. & Dimensional Inspection		App G	8					
8.	Rescreen Test Dielectric	1016	30568	8					
9.	Room Temp. Dry			8					
10.	Radiant Dry			8					
11.	Dimensional Inspection		App G	8					
12.	Fire Substrates	1016		8					
13.	Vis. and Dimensional Inspection		App G	8					
13.A.	Dye Check (6,7,8)	1622	App G	3					Dye Check Result: _____

DIELECTRIC AND CROSSOVER GLAZE APPROVAL ROUTE AND DATA SHEET

M.I.D. Lot No.:

Op. No.	Operation Name	D.S. No.	Screen No.	No. Pcs.	Date		Oper/ Insp.	Mach. No.	Data
					In	Out			
14.	Screen Control Dielectric	1016	30568	8					
15.	Room Temperature Dry			8					
16.	Radiant Dry			8					
17.	Fire Substrates	1010		8					
18.	Visual & Dimensional Inspection		App G	8					
19.	Rescreen Control Dielectric	1010	30568	8					
20.	Room Temp. Dry			8					
21.	Radiant Dry			8					
22.	Dimensional Inspection								
23.	Fire Substrates	1010		8					
24.	Visual & Dimensional Inspection		App G	8					
24a	Dye Check (C6, C7, C8)	1622	App G	3					Dye Check Results
25.	Screen and Dry Conductor Paste (See Note 2)	1007	30569	10					
26.	Fire Conductor Pattern			10					
27.	Visual Inspection		App G	10					
28.	Fire Substrates 1, 2, C1 and C2 13 times	1007 1012		4					
29.	Check Substrates 1, 2, C1 and C2 for Adhesion		App G & A	4					

DIELECTRIC AND CROSSOVER GLAZE APPROVAL ROUTE AND DATA SHEET

M.I.D. Lot No.:

Op. No.	Operation Name	O.S. No.	Screen No.	No. Pcs.	Date		Oper/ Insp.	Mach. No.	Data
					In	Out			
30.	Check substrates 3, 4, 5, C3, C4 and C5 for Resistance of electrode		App G	6					3 4 5 C3 C4 C5
31.	Screen Test Dielectric on Substrates 3, 4, 5	1016	30568	3					
32.	Room Temp. Dry			3					
33.	Radiant Dry			3					
34.	Fire Substrates	1016		3					
35.	Visual Inspection		App G	3					
36.	Rescreen Test Dielectric on Substrates 3, 4, 5	1016	30568	3					
37.	Room Temp. Dry			3					
38.	Radiant Dry			3					
39.	Fire Substrates	1016		3					
40.	Visual Inspection			3					
41.	Screen Control Dielectric on Substrates C3, C4, and C5	1016	30568	3					
42.	Room Temp. Dry			3					
43.	Radiant Dry			3					
44.	Fire Substrates			3					
45.	Visual Inspection		App G	3					

# DIELECTRIC AND CROSSOVER GLAZE APPROVAL ROUTE AND DATA SHEET

O.S. 1506  
Page 19  
App. D Rev. 2

M.I.D. Lot No.:

Op. No.	Operation Name	O.S. No.	Screen No.	No. Pcs.	Date		Oper/ Insp.	Mach. No.	Data
					In	Out			
46.	Rescreen Control Dielectric on Substrates C3, C4, C5	1016	30568	3					
47.	Room Temp. Dry			3					
48.	Radiant Dry			3					
49.	Fire Substrates	1016		3					
50.	Visual Inspection			3					
51.	Check Substrates 3, 4, 5, C3, C4, C5 for Electrode Resistance		App G	6					
52.	Screen and Dry Second Electrode (See Note 2)	1007	30570	6					
53.	Fire Conductor Pattern	1007 1012		6					
54.	Visual Inspection			6					
55.	Fire Substrates 13 Times	1007 1012		6					
56.	Visual Inspection			6					
57.	Adhesion Inspection		App G & A	6					
58.	Check Resistance Between Conductor Layers		App G	6					
59.	Apply 50 volts D.C. with one Electrode Pattern at Ground and the other at 50 VDC			6					



DIELECTRIC AND CROSSOVER GLAZE APPROVAL ROUTE AND DATA SHEET

M.I.D. Lot No.: \_\_\_\_\_

Op. No.	Operation Name	O.S. No.	Screen No.	No. Pcs.	Date		Oper/ Insp.	Mach. No.	Data
					In	Out			
60.	Check Resistance Between Conductor Layers		App G	6					
61.	Process Engineering and Q.C. Engineering Data Review and Disposition								

Note 2: Gold shall be air dried for 15 minutes at room ambient before radiant (belt) drying.

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App. E

Indicate in the spaces above the reject substrate number, location and actual dimension of via. If additional space is required please make notes on reverse side of this sheet. Also, indicate in the data column of the lot traveler if any discrepant vias were found.

Substrate	Initial Reading	Reading After Dielectric Cover	$\Delta$	% $\Delta$	A/R	Comments
3						
4						
5						
C3						
C4						
C5						

Insp.: \_\_\_\_\_ Date: \_\_\_\_\_

Insp.:  
Date:[illegible]

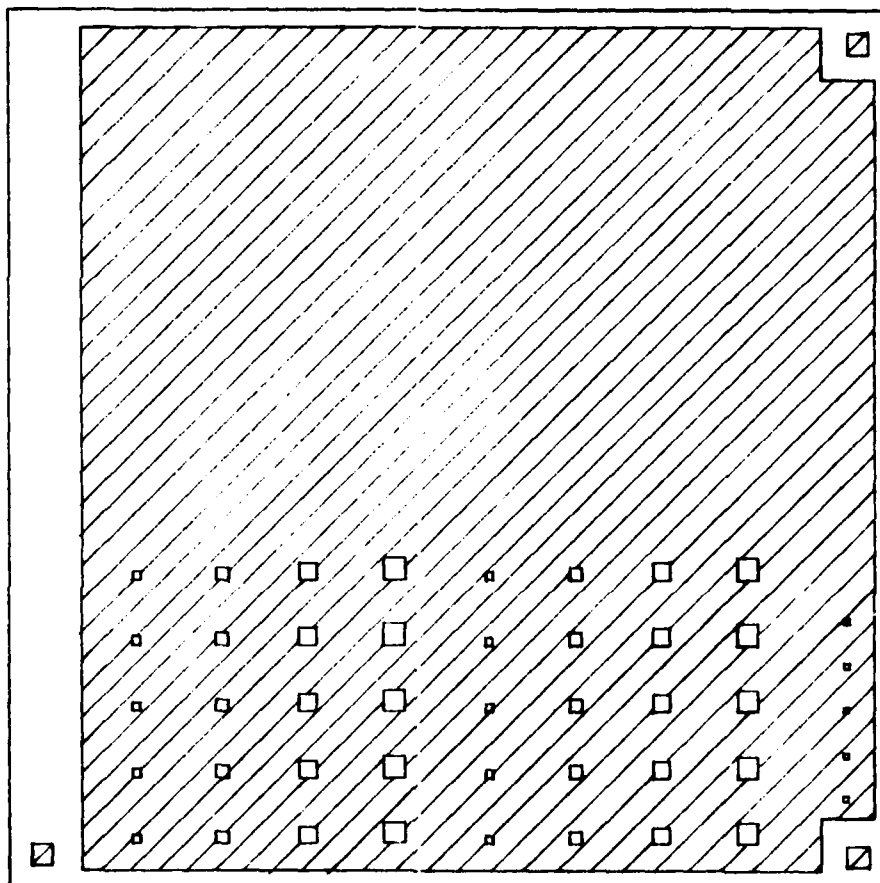


RAYTHEON COMPANY

Form 20-0044

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Subject		POC 77-6344

App. F-I



30568 Glaze  
30569 #1 Cond.  
30570 #2 Cond.

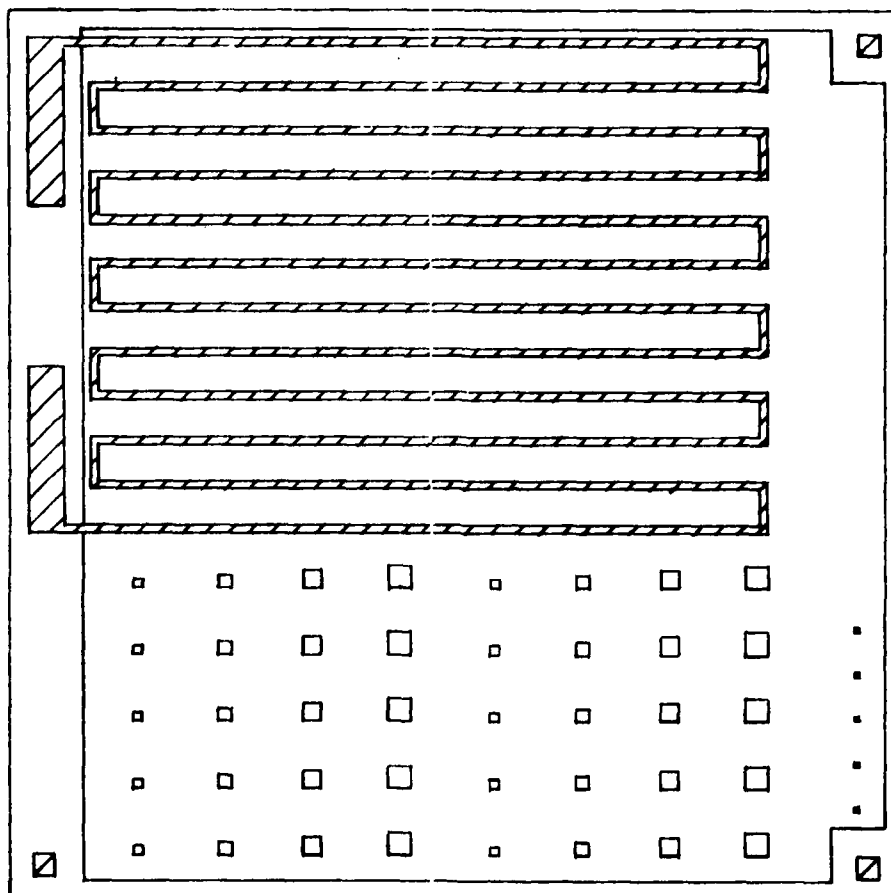


RAYTHEON COMPANY

Form 20-0044

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Subject	App. F-2
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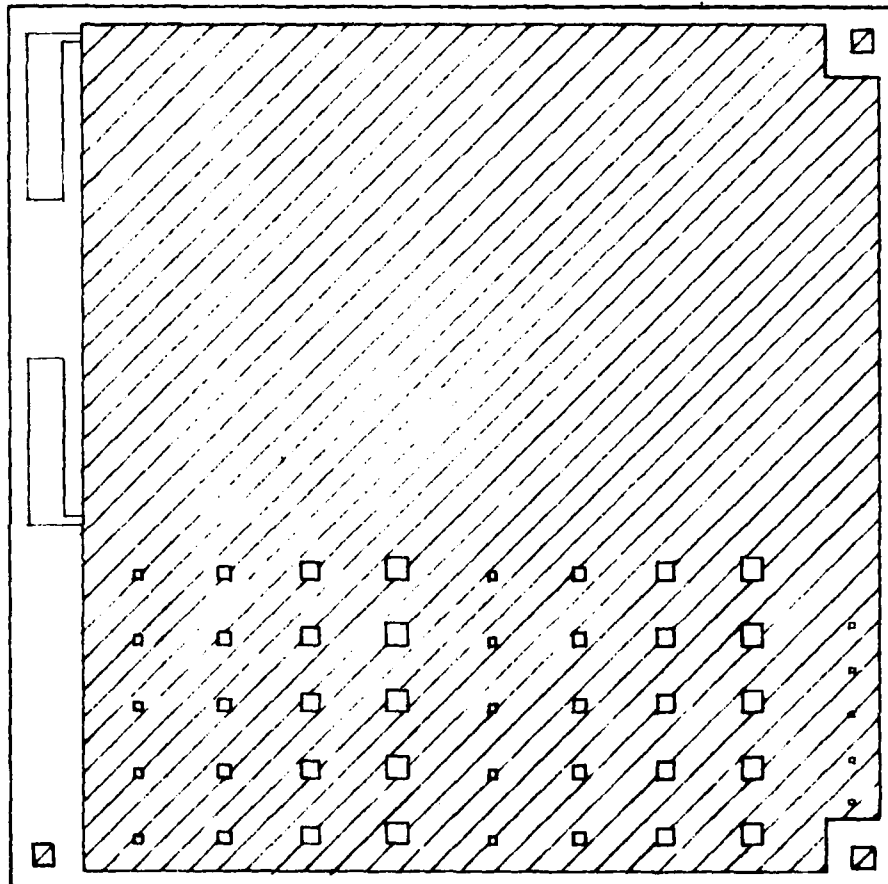


RAYTHEON COMPANY

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Subject
App. F-3





RAYTHEON COMPANY

Form 20-0044

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Standard

1506

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1

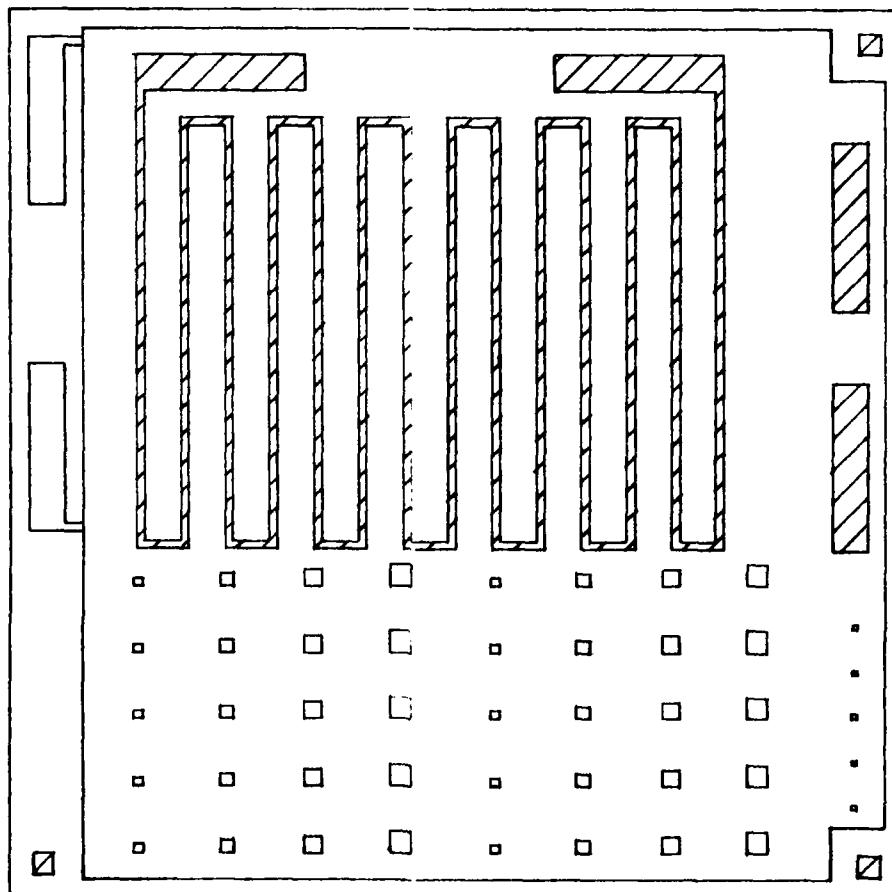
Date

Sept. 20, 1977

Subject

App. F-4

POC 77-6344



Scribe  
Test

Scribe  
Test



RAYTHEON COMPANY

Form 0011

Operation Standard 1506	
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Subject DIELECTRIC AND CROSSOVER GLAZE APPENDIX G	
POC 77-6344	

Net Weight: Within 2 grams of specified weight.

Particle Size Distribution No particles larger than 25 microns. Average particle size must be between 2 and 7 microns.

Dielectric vias Dimensional Inspection Length and width must not be changed by more than 10% compared to the screen via dimension.

NOTE: 0.005" via inspection is for information only.

Visual (dielectric and conductor)

1. There must be no evidence of voids or bubbles under 30X magnification unless caused by process contamination.
2. The dielectric (double screened) shall have less than one dye spot per 15 Mil square area, when checked with dye penetrant

Adhesion - Dielectric Dielectric must appear hard resulting in flaky separation. Putty-like consistency is not acceptable.

Adhesion - Gold Gold pattern should not be capable of being lifted. Scribbing shall result in flaking or scratching.

Electrode Resistance Shift INFO only

Resistance between electrodes before and after application of 50 V.D.C. Resistance reading on a D.V.M. shall indicate an "Off Scale" reading at the highest scale setting.

DIELECTRIC AND CROSSOVER GLAZE APPROVAL ROUTE AND DATA SHEET  
FOR SINGLE DIELECTRIC LAYER SUBSTRATES (Two Cond. Layer) ONLY

JAR NO:

Rev. 0

Test Vehicle Substrate No.: 26219-29  
Paste No. Under Test \_\_\_\_\_  
Vendor: \_\_\_\_\_  
Vendor Lot No.: \_\_\_\_\_  
M.I.D. Lot No.: \_\_\_\_\_

Conductor Paste Type \_\_\_\_\_  
Conductor Paste Lot No. \_\_\_\_\_  
Control Paste Lot No. \_\_\_\_\_  
Control Paste Jar No. \_\_\_\_\_

Jar No. \_\_\_\_\_

P.O. No.: \_\_\_\_\_ Viscosity as Rec'd: \_\_\_\_\_  
Date Rec'd: \_\_\_\_\_ Particle Size: \_\_\_\_\_  
Paste Weight: \_\_\_\_\_ Distribution: \_\_\_\_\_

OP NO.	Operation Name	O.S. No.	Screen No.	No. Pcs.	Date		Oper/ Insp.	Mach. No.	DATA
					In	Out			
1.	Clean Substrates	1000		12					
2.	Mark Substrates			12					
3.	Screen and Dry Conductor Paste	1007	30569	12					
4.	Fire Conductor	1012		12					
5.	Visual Inspection	App G		12					
6.	Check Resistance of Conductor	App G		12					
7.	Screen Test Dielectric	1010	30568	6					
8.	Screen Control Dielectric	1010	30568	6					
9.	Room Temp. Dry			12					
10.	Radiant Dry			12					
11.	Fire Dielectrics	1012		12					
12.	Visual and Dimen- sional Inspection	App G		12					



AD-A086 344

RAYTHEON CO QUINCY MASS INDUSTRIAL COMPONENTS OPERATION F/G 9/1  
MANUFACTURING METHODS AND TECHNOLOGY ENGINEERING (MM AND TE) PR--ETC(U)  
DAAB07-76-C-8119  
APR 80 R M ZILBERSTEIN

UNCLASSIFIED

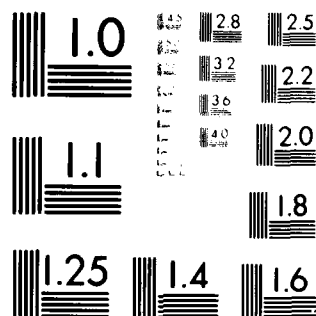
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3 OF 3

ALL INFORMATION CONTAINED  
HEREIN IS UNCLASSIFIED



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DATE  
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MICROCOPY RESOLUTION TEST CHART  
NATIONAL BUREAU OF STANDARDS-1963-A

DIELECTRIC AND CROSSOVER GLAZE APPROVAL ROUTE AND DATA SHEET  
FOR SINGLE DIELECTRIC LAYER (TWO CONDUCTOR LAYER) ONLY

Rev. 0

M.I.D. Lot No.: \_\_\_\_\_

OP NO.	Operation Name	O.S. No.	Screen No.	No. Pcs.	Date		Oper/ Insp.	Mach. No.	Data
					In	Out			
13.	Rescreen Test Dielectric	1010	30568	6					
14.	Rescreen Control Dielectric	1010	30568	6					
15.	Room Temp. Dry			12					
16.	Radiant Dry			12					
17.	Fire	1012		12					
18.	Visual & Dimen.	App G		12					
19.	Dye Test 1-3 C1-C3	1622		6					
20.	Check Resistance	App G		6					
21.	Screen Top Conductor	1007		6					
22.	Room Temp. Dry			6					
23.	Radiant Dry			6					
24.	Fire	1012		6					
25.	Visual Exam & Adhesion	App G App. A		6					
26.	Check Resistance Between Conductor Layers			6					
27.	Apply 50VDC between Conductor Layers			6					
28.	Check Resistance between Conductor Layers			6					



RAYTHEON COMPANY

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Subject

DIELECTRIC AND CROSSOVER GLAZE  
PASTE APPROVAL PROCEDURE5.0 PROCEDURE: Cont.

- 5.3.24 Fire the six (6) substrates per the schedule on the flow diagram of Appendix H-2. (Reference: O.S. 1007 and 1012).
- 5.3.25 Inspect visually for bubbling and voids on the electrode surface in accordance with the specification of Appendix G.
- 5.3.26 Fire substrates thirteen (13) times in accordance with the schedule of the flow diagram of Appendix H-2. (Reference: O.S. 1007 and 1012).
- 5.3.27 Visually inspect the fired substrates to the criteria of Appendix G.
- 5.3.28 Perform conductor and dielectric adhesion inspection in accordance with the instruction of Appendix A and the criteria of Appendix G.
- 5.3.29 Check resistance between conductor layers by applying a probe of a digital ohm-meter to each conductor pattern. Refer the specification sheet of Appendix G. If a short circuit is present do not continue the test on the defective substrate.
- 5.3.30 Apply 50 volts  $\pm$  2 volts to the conductor layers. One probe of the power supply should be placed on tab of one electrode pattern and the other probe placed on the tab of the second electrode pattern. Use a D.C. power supply with greater than 50 volts capacity.



RAYTHEON COMPANY

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Subject

DIELECTRIC AND CROSSOVER GLAZE  
PASTE APPROVAL PROCEDURE5.0 PROCEDURE: Cont.

5.3.31 Check resistance between conductor layers as in paragraph 5.3.29.

5.4 Screening and Inspection Procedure for Dielectric used in Single Dielectric Layer Substrates.

5.4.1 Clean twelve (12) substrates per O.S. 1000. Use substrate P/N 26219-29.

5.4.2 Mark six (6) substrates with numbers 1 to 6, and 6 substrates with numbers C1 to C6.

5.4.3 Screen and dry the applicable conductor material on all twelve (12) substrates using screen no. 30569.'

5.4.4 Fire all twelve (12) substrates per the flow diagram of Appendix J-1. (Reference O.S. 1012).

5.4.5 Inspect visually for bubbling and voids on the conductor surface in accordance with the specification of Appendix G.

5.4.6 Check substrates for electrode resistance. Record data on Appendix K.

5.4.7 Screen Test dielectric on substrates 1-6 and the control dielectric on substrates C1-C6 using screen no. 30568.

5.4.8 Allow screened substrates to dry at room ambient for 15 minutes.

5.4.9 Radiant dry the screened substrates using the belt dryer.



RAYTHEON COMPANY

Form 10014

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5.0 PROCEDURE: Cont.

- 5.4.10 Fire the substrates per the flow diagram of Appendix J-1 (reference O.S. 1012).
- 5.4.11 Under 30x magnification using a Stereozoom microscope with backlighting, check for visual and dimensional criteria per Appendix G. The microscope should contain a reticule for dimensional inspection.
- 5.4.12 Rescreen the pattern of P/N 30568 and follow steps of 5.4.8 through 5.4.11, including dimensional inspection.
  - 5.4.12.1 Dye Test C1-C3 and 1-3 for porosity per O.S. 1622.
- 5.4.13 Check the resistance of bottom electrode. Record data.
- 5.4.14 Screen the applicable top conductor material on the remaining six (6) substrates using screen no. 30570.
- 5.4.15 Dry 15 minutes at room ambient .
- 5.4.16 Radiant dry the substrates using the belt dryer.
- 5.4.17 Fire the six substrates per the flow diagram of Appendix J-1. (Reference O.S. 1012).
- 5.4.18 Visually inspect the fired substrates to the criteria of Appendix G.
- 5.4.19 Perform conductor and dielectric adhesion inspection in accordance with the instruction of Appendix A and the criteria of Appendix G.



RAYTHEON COMPANY

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POC 77-6344	

Subject DIELECTRIC AND CROSSOVER GLAZE  
PASTE APPROVAL PROCEDURE

5.0 PROCEDURE: Cont.

- 5.4.20 Check resistance between conductor layers by applying a probe of a digital ohm-meter to each conductor pattern. Refer to the specification sheet of Appendix G. If a short circuit is present, do not continue the test on the defective substrate.
- 5.4.21 Apply 50 volts  $\pm 2$  volts to the conductor layers. One probe of the power supply should be placed on tab of one electrode pattern and the other probe placed on the tab of the second electrode pattern. Use a D.C. power supply with greater than 50 volts capacity.
- 5.4.22 Check resistance between conductor layers as in paragraph 5.4.20.

5.5 Engineering Review and Disposition:

- 5.5.1 The cognizant Quality Control and Screening Engineers shall review all approval data and provide disposition on the approval form of Appendix C. Any use restrictions shall be noted on the form.
- 5.5.2 Copies of the approval and data forms shall be forwarded to M.I.D.; the Paste Room technician, and the cognizant Screening Room Engineer. If restrictions are noted on the approval form an extra copy shall be forwarded to MID. A copy of the approval form only shall be forwarded to Production Control.



RAYTHEON COMPANY

Form 70-1014

		Operation Standard 1506	
		Sheet 12	Rev. 1
Subject DIELECTRIC AND CROSSOVER GLAZE PASTE APPROVAL PROCEDURE		Date September 20, 1977	
		POC 77-6344	

5.0 PROCEDURE: Cont.

- 5.5.3 Upon receipt of an approved form, the MID inspector shall label the subject paste jar with either an accept or reject notation. If a restriction is noted on the approval form, a notation of the jar shall be placed with the words "Restricted - Use". A copy of the approval form shall also be provided by MID and placed with the subject jar, if the jar has a use restriction.
- 5.5.4 Rejected jars shall be placed in a special "Reject Area" until appropriate disposition of the rejected jar is made.



**RAYTHEON**

RAYTHEON COMPANY

Operation  
Standard 1506

Sheet 13 Rev. 1

Date Sept. 20, 1977

Subject  
ADHESION TEST PROCEDURE APPENDIX A

POC 77-6344

**1.0 EQUIPMENT:**

Phono-Point Diamond Tip (75° Angle) and Microscope with 10X to 30X magnification.

**2.0 PROCEDURE:**

Use the diamond tool and microscope to perform the following test.

**2.1 Metallization (Conductor) to Dielectric:**

With the diamond tip scribe one electrode test pad with moderate force at approximately a 45° angle from the surface of the substrate and in a direction away from the tester. When testing the "second electrode pattern" a separate gold conductor pattern has been provided at the upper right of the substrate for this purpose. See Appendix F-4 pictorial.

**2.2 Adhesion of Dielectric to Substrate and Dielectric Hardness:**

Test as in 2.1 above except that the area to be scribed will be any corner of the dielectric at the lower portion of the substrate. See Appendix F pictorials.

**3.0 OBSERVATION:**

Record all observations in the Data Column of the lot traveler. Use descriptive words indicating adhesion of dielectric and conductor materials. Such words as flaking and peeling are appropriate. If the dielectric cuts like "putty" make such a notation. The amount of hand pressure required to scribe should be noted, such as light force, moderate force, etc. Also the layer at which separation takes place should be noted.

**4.0 Refer Appendix G for specifications.**



RAYTHEON COMPANY

Form 10-44

Operation Standard	1506	
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Subject	PASTE RECEIVAL AND RECORD FILE (MID FORM) APPENDIX B	
	POC 77-6344	

Part No.: \_\_\_\_\_

MID Lot No.: \_\_\_\_\_

P.O. No.: \_\_\_\_\_

Vendor Lot No.: \_\_\_\_\_

Vendor P/N: \_\_\_\_\_

Weight Per Jar From Label: \_\_\_\_\_

Other Label Data: \_\_\_\_\_

Date Received: \_\_\_\_\_

Date Approved/Rejected: \_\_\_\_\_

Paste Name: \_\_\_\_\_

Vendor: \_\_\_\_\_

Accepted: ☐

Restrictions - List Below:

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Rejected: ☐

Reason For Rejection And Disposition:

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RAYTHEON COMPANY

Form 20-0044

Operation Standard 1506	
Sheet 15	Rev. 1
Date Sept. 20, 1977	
POC 77-6344	

Subject  
ENGINEERING APPROVAL VERIFICATION  
APPENDIX C

Paste Type No.: \_\_\_\_\_

MID Lot No.: \_\_\_\_\_

Jar No.: \_\_\_\_\_

Vendor: \_\_\_\_\_

Vendor Lot No.: \_\_\_\_\_

P.O. No.: \_\_\_\_\_

Weight: \_\_\_\_\_

Date Rec'd: \_\_\_\_\_

Approval Completed: \_\_\_\_\_

Data Review: Record below any test results not meeting specification.

Disposition:

Accept: \_\_\_\_\_ Reject: \_\_\_\_\_ Complete IMR If Rejected

Use Restriction:

Quality Control Engineering: \_\_\_\_\_ Date: \_\_\_\_\_

Paste Engineer: \_\_\_\_\_ Date: \_\_\_\_\_



Subject

## PASSIVE LASER TRIM/ LOAD & UNLOAD

To laser trim fired resistors to specified values by reducing the effective area of the resistor.

Hands will remain outside the work area (under hood) while trimming.

ES1, model 44, laser trim system with proper substrate nest.  
Passive trim program.

See applicable OS #      for screening, laser trimmable, substrates.

### A. Set Up

1. Technician, or engineer, will access passive trim program.
2. Adjust, align and position substrate for proper probe contact.
3. The actual trim path will be checked and corrected as necessary.
4. Verify the laser measurement system with an off line bridge.

### A. Trim

1. Technician will call laser system into run mode.
2. Position substrate using required bank points, on handler.
3. Depress foot peddle, position ~~sub~~strate in work area, and release foot peddle.

[illegible]



RAYTHEON COMPANY

Form 214-0984

Operation Standard	1685	
Sheet	2	Rev. 0
Date	Feb. 21, 1978	
Subject	POC 78-6061	

PASSIVE LASER TRIM/LOAD &amp; UNLOAD

#### 6.0 PRODUCTIVE RUN: Cont.

4. Press the proceed button on the console.
5. While substrate is being trimmed load the next substrate.
6. An accept, and/or reject light will inform the operator whether or not substrate is acceptable.
7. After trim completion, depress peddle and slide handler to position next substrate. Release peddle and remove trimmed substrate.
8. Press the procede button.
9. Repeat steps 2 through 9 until 5 pieces have been trimmed.
10. Give the first 5 pieces to Q.C., for visual and post trim, in process inspection.
11. Upon Q.C. acceptance, switch man/auto switch to auto, and proceed with steps 2 through 9. While in auto, the procede button does not have to be used.

#### 7.0 SALVAGE:

All rejects will be inspected by laser personel and salvaged, if possible.

Operation Standard		1721
Sheet 1	Rev. 1	
Date August 16, 1978		
POC 78-6441		

1.0 This instruction provides details for the control of crystals used in the TCVCXO module. (ECOM Program) Note: Crystals and crystal curves for this program are supplied by the government. Universal, Raytheon, I.C.O. procedures are applicable to this program except as modified herein.

## 2.0 RECEIVING:

- 2.1 The receiving department shall apply an identification lot number to the shipping container. Copies of the receiving report shall be distributed to the DCAS representative and the Government Property Administrator. After normal administrative receiving procedures have been completed the product shall be delivered to the receiving inspection department (MID).
- 2.2 The receiving inspection department (MID) shall perform all normal administrative functions and provide inspection in accordance with the applicable receiving inspection instruction (detail sheet).
- 2.3 MID personnel shall apply the lot number and "Letter Designation" (See para. 2.4) to all graph sheets and other pertinent received documents and MID data sheets. After the markings have been affixed a copy of each received document shall be made and forwarded with the product. The original documents shall be maintained on file in MID.
- 2.4 Letter Designation - Each lot number shall have a corresponding letter designation. A chart shall be maintained in MID to show the corresponding letter designation for each lot. The letter designation shall commence with A. The second twenty six lots shall be labeled AA, AB, AC, etc. the third group of twenty six lots shall be labeled BA, BB, BC, etc.
- 2.5 Labeling of Crystals - The lot letter designation shall be applied to each crystal using pencil.

Ceramic packaged crystals - apply directly to ceramic  
Oval crystal can package - apply to gummed label already on can  
T0 5 package - apply to gummed label and stick to can. Use only  
labels which require wetting of adhesive.

- 2.6 Crystal identification log - MID personnel shall provide the crystal identification log form. (App. A) They shall fill out the MID section of this form and forward the form to stores with the accepted product. The column labeled "Turning Pt.  $\Delta$ Hz" requires calculated data derived from the curves supplied. In addition the trimmed values of R47 and R48 of the TCFG module shall be determined from the turning point. These values shall be recorded in the appropriate columns. A table of R47 and R48 will be found in Appendix B.

[illegible]



# RAYTHEON COMPANY

Operation Standard	1721
Sheet 2	Rev. 1
Date	August 16, 1978
Subject	TCVCXO CRYSTAL CONTROL
	POC 78-6441

## 2.0 RECEIVING: CONT.

- 2.7 Rejected material - A material review form shall be filled out and the required signature obtained. In addition the DCAS representative shall be notified by the cognizant quality control engineer on a verbal basis. A copy of any resulting Material Review Disposition Report shall be forwarded to the Government Property Administrator.
- 2.8 Delivery to stores - The accepted crystals, the applicable graphs (curves) and the crystal identification log shall be forwarded to the stockroom.

## 3.0 STOCKROOM:

- 3.1 Stores personnel shall store the crystals in an area (shelf) designated "Government Furnished Material". The accompanying curves shall be stored with the product. The crystal identification log sheet shall be placed in a permanent "Crystal Log" notebook.
- 3.2 VCXO Kit Assembly - Stores personnel shall provide VCXO Kits for production control requirements. The kits shall be organized into lots and identified with the standard six digit hyphenated lot number. Stock room personnel shall provide three documents for each kit. These are:

- 3.2.1 The standard lot traveler
- 3.2.2 The crystal - VCXO Identification Log (see para. 3.4)
- 3.2.3 Stores issue sheet which will provide traceability for all semiconductor, capacitor, and substrate lots.

NOTE: The crystal is part of the VCXO Kit.

- 3.3 TCFG Kit Assembly - Stores personnel shall provide TCFG Kits for production assembly in accordance with production control requirements. The kits shall be organized into lots and identified with the standard six digit hyphenated lot number. Stock room personnel shall provide three documents.

- 3.3.1 The standard lot traveler
- 3.3.2 The crystal - TCFG Identification log (see para. 3.5)
- 3.3.3 Stores issue sheet which will provide traceability for all semiconductors, capacitors, and substrate lots.



RAYTHEON COMPANY

Form 20-0044

		Operation Standard 1721	
		Sheet 3	Rev. 0
		Date 13 June 1978	
Subject TCVCXO CRYSTAL CONTROL		POC 78-6321	

3.0 STOCKROOM: CONT.

## 3.4 The Crystal - VCXO Identification Log (See App. C)

- 3.4.1 Stockroom personnel shall initiate the crystal - VCXO log and maintain a copy in stores. An equal number of crystals shall be assigned to the lot. The Crystals letter lot designation and serial nos. shall be recorded in their respective columns.
- 3.4.2 The VCXO serial number range shall be assigned to each VCXO lot. The number shall consist of a hyphenated five (5) digit code. The first three (3) digits shall be the last three (3) digits of the lot number. A hyphen shall follow. The number shall end with a two (2) digit sequential number. The serial number range shall be recorded in the appropriate spaces of the Crystal-VCXO identification log. A copy of the Crystal-VCXO log shall be attached to the VCXO lot traveler.

## 3.5 The Crystal - TCFG Identification log (See app. D.)

- 3.5.1 Stockroom personnel shall initiate the crystal TCFG log and maintain a copy in stores. A VCXO lot shall be assigned to the TCFG lot. The R47 and R48 values associated with each crystal shall be recorded on the TCFG log. These values may be obtained from the crystal identification log.
- 3.5.2 TCFG serial numbers shall be assigned to each TCFG lot. The number shall consist of a hyphenated five (5) digit code. The first three (3) digits shall be the last three (3) digits of the lot number. A hyphen shall follow. The number shall end with a 2 digit sequential number. These range of serial numbers shall be recorded in the appropriate spaces of the Crystal-TCFG identification log. A copy of the Crystal-TCFG log shall be attached to the TCFG lot traveler.

## 3.6 Completed VCXO and TCFG lots shall be returned to stores. Production shall form kits using the above modules for marriage of the VCXO and TCFG modules. The Crystal identification log should be used to match the appropriate VCXO and TCFG lots.

3.7 Defective modules with good crystals - Good crystals removed from defective modules shall be returned to stores. Stores personnel shall reassign the crystal to other VCXO and TCFG units. Proper notation of this transfer shall be made on all log sheets. Line numbers on the crystal identification log are provided so that reference may be made by line number to indicate the transfer of the crystal.

## 3.8 Defective crystals shall be returned to stores and a new crystal assigned to the applicable VCXO and TCFG modules. All logs should reflect this new assignment. The defective crystal shall be transferred to MID where appropriate administrative action shall take place.



# ECOM PROGRAM

# CRYSTAL IDENTIFICATION LOG

**P/N 32171-**

[illegible]

TURNING POINT VERSUS TCFG-R47 and R48 TRIMMED CENTER VALUES

TURNING POINT	Kohms		TURNING POINT	Kohms	
	R47	R48		R47	R48
140	10	40.4	295	10.2	10
145		38.3	300	10.7	
150		36.2	305	11.2	
155		34.3	310	11.7	
160		32.5	315	12.2	
165		30.7	320	12.8	
170		29.3	325	13.3	
175		28.2	330	13.8	
180		27.0	335	14.3	
185		25.9	340	14.8	
190		24.8	345	15.4	
195		23.8	350	16.1	
200		22.8	355	16.9	
205		21.8	360	17.6	
210		20.8	365	18.3	
215		19.8	370	19.0	
220		19.1	375	19.7	
225		18.3	380	20.5	
230		17.5	385	21.3	
235		16.7	390	22.1	
240		15.9	395	22.9	
245		15.2	400	23.7	
250		14.6	405	24.5	
255		14.0	410	25.4	
260		13.5	415	26.5	
265		13.0	420	27.5	
270		12.4	425	28.4	
275		11.9	430	29.6	
280		11.4	435	30.8	
285	10	10.9	440	32.0	
290		10.3	445	33.2	
			450	34.5	
			455	35.9	
			460	37.4	
			465	38.8	
			470	40.3	10







**RAYTHEON COMPANY**

Operation Standard		1725
Sheet	1	Rev. 0
Date June 27, 1978		
POC 78-6358		

## 1.0 EQUIPMENT REQUIRED:

- 1.1 Power Supply - 12 V
- 1.2 Digital Voltmeter - 4 Digit Resolution minimum, 0.2% accuracy minimum
- 1.3 Oscilloscope - 50MHz Band Width minimum, 7pf Probe
- 1.4 Frequency Counter - 25 MHz minimum, Resolution - 1Hz
- 1.5 Test Box B78-25-E1
- 1.6 Jewelers screwdriver

## 2.0 SET UP:

- 2.1 Connect as shown in Figure 1.
- 2.2 Adjust power supply to 12 volts.
- 2.3 Adjust oscilloscope for 0.5 volts per division (including probe) vertical and 0.5 microseconds per division horizontal.
- 2.4 Adjust freq counter to read a 20 MHz signal to 1Hz resolution.
- 2.5 Test Box - 12V switch on  
Function switch - E Anal.  
Volt switch - 2.5V

**Adjust power supply to get a reading of 2.500 volts on D.V.M.**

### 3.0 OPERATION:

- 3.1 12V switch OFF  
Function switch TP1  
Volt switch 2.5V
- 3.2 Insert unit
- 3.3 12V switch ON

[illegible]



RAYTHEON COMPANY

Form 20-6044

Operation Standard 1725	
Sheet 2	Rev. 0
Date June 27, 1978	
POC 78-6358	

Subject	ECOM FUNCTIONAL TEST PROCEDURE TCVCXO
---------	---------------------------------------

3.0 OPERATION: CONT.

3.4 Test unit per Table 1.

3.5 12V switch OFF.

3.6 Remove unit.

TABLE 1

TEST	PARAMETER	FUNC SWITCH	VOLT SWITCH	METER	LIMITS		UNITS	NOTES
					MIN	MAX		
1.	Potentionmeter Range Adjust	TP1	2.5V	CTR	21937390	21937609	Hz	Adj. Pot 3.0V TP1 5.0V
2.	Set $F_c$	TP1	2.5V	CTR	21937498	21937502	Hz	Adj. Pot.
3.	Voltage Reg.	9V	2.5V	DVM	8.985	9.020	V	
4.	Freq. DEV -	TP1	1.75V	CTR	21937848	21937907	Hz	Check $F_c$ - Adjust if necessary
5.	Freq. DEV +	TP1	3.25V	CTR	21937093	21937152	Hz	
6.	RF Output	TP1	2.5V	Scope	1	-	Vpp	

O.S. 1725 Rev. 0  
 Sheet 3 of 4  
 POC 78-6358  
 June 27, 1978

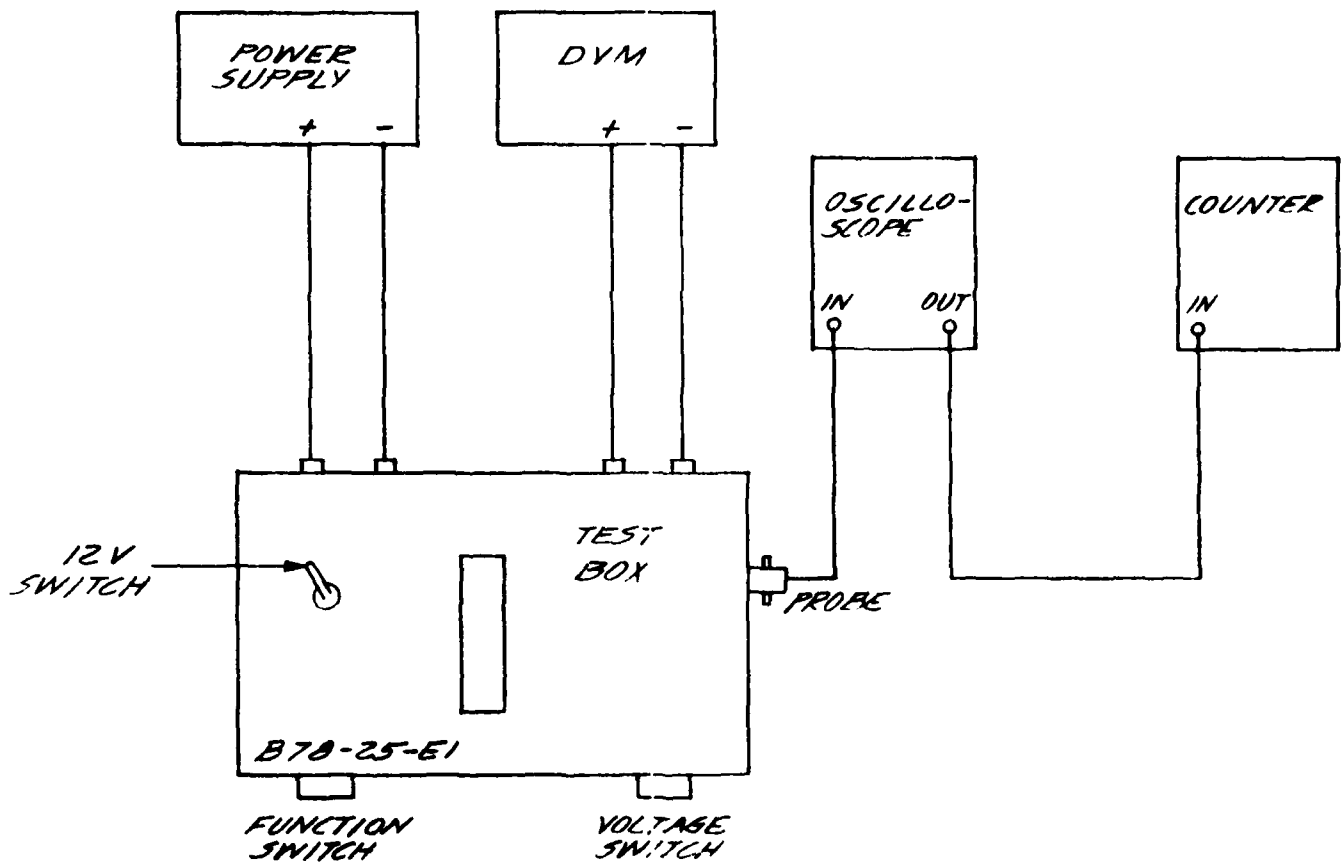


FIGURE 1





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Date Oct. 19, 1978		
POC 78-6572		

5.8

[illegible]



# RAYTHEON COMPANY

Form 20-0044

		Operation Standard	1748
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Subject	ECOM-TCFG PASSIVE TRIM SET-UP		POC 78-6572

## 4.0 FOCUS INSPECTION: Cont.

- 4.5 Inspect for substrate penetration X and Y. (They should be the same).
- 4.6 Once kerf width is 1 to 2 mils, substrate penetration 4 to 8 microns, the laser is properly focused. Lock lense in place.

## 5.0 PROBE CARD ALIGNMENT AND ADJUSTMENT:

- 5.1 This procedure will be repeated twice. TCFG substrates require two trimming passes.
- 5.2 Pass 1 requires pass 1.TCF software support and TCFG-1 probe card.  
Pass 2 requires pass 2.TCF software support and TCFG-2 probe card.  
Note: Cards and software are not interchangeable.
- 5.3 Mount probe card adapter and fasten firmly.
- 5.4 Insure proper handler height before installing fixed probe card. Adjust to maximum height initially.
- 5.5 Adjust down travel limit, on handler, for minimum down travel initially.
- 5.6 Run TK2, get proper software support, and proceed. TK2 will allow joy stick control of table.
- 5.7 After initial handler adjustments, gently insert probe card into adapter without bumping probes.
- 5.8 Firmly adjust slide fails on probe card. Do not tighten at this time.
- 5.9 Locate substrate on nest and rotate handler into work area.
- 5.10 Align X, Y,  $\phi$  on substrate holder (nest) until all probes are in approximately the right area.
- 5.11 Slowly adjust down travel, insuring probes clear all obstructions (corral), to approx. 1/16 of an inch above substrate.
- 5.12 Re-align substrate nest and card holder until all probes are properly located.
- 5.13 Adjust handler up travel limit for 20 mils minimum clearance of corral. Lock in place with thumb screw located top rear center of handler.



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POC 78-6572	

Subject	ECOM-TCFG PASSIVE TRIM SET-UP
---------	-------------------------------

#### 5.0 PROBE CARD ALIGNMENT AND ADJUSTMENT: Cont.

- 5.14 Adjust down travel limit for 5 to 10 mils overdrive (travel below substrate surface) and lock in place.
- 5.15 With laser off verify system probe operation by running program. If an invalid measurement is recorded, recheck the alignment of substrate and probe card.
- 5.16 Repeat steps 10 thru 15, as required.
- 5.17 If a problem still exists and cannot be resolved, engineering assistance may be required.
- 5.18 Do not proceed unless system is measuring all resistors.

#### 6.0 TRIMMING:

- 6.1 Disengage computer (control C), open floppy disk doors, turn system power switch off, and disconnect model 44 wall plug.
- 6.2 Insert key in laser power supply and turn on and off several times to surge water.
- 6.3 Wait approx. 30 seconds and depress start button, located front panel of laser power supply, to start laser. Repeat as necessary. If lamp fails to start assistance may be required. Lamp will usually fire within 5 minutes.
- 6.4 With laser "ON", plug system power in and boot strap model 44.
- 6.5 Run TK2, pass 1. TCF or pass 2. TCF.
- 6.6 Step through trim sequence using "sing", to determine cut travel parameters.
- 6.7 Adjust trim parameters or load new positions as necessary.
- 6.8 Before activating laser recheck all trim positions and measurements.
- 6.9 Adjust laser to recommended power level.
- 6.10 Turn laser from "stand-by" to "on", and trim 2 pieces.
- 6.11 Open all resistor loops and verify measured values with laser measurement system.
- 6.12 Correct (minor adjustments) power densities, if needed.



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Subject

ECOM-TCFG PASSIVE TRIM SET-UP

POC 78-6572

6.0 TRIMMING:

6.13 Once everything seems acceptable, trim 5 pieces for QC evaluation.

6.14 If QC accepts product then trimming should proceed according to O.S. 1685, if not, make the required modifications and resubmit a 5 piece sample.

7.0 SAFETY:

No trimming with interlocks cheated. Hand must remain outside work area when laser is on.

8.0 INSPECTION:

Random sampling should occur during trimming as required by O.S.#.



## RAYTHEON COMPANY

Form 20-0044

Operation Standard 1755	
Sheet 1	Rev. 0
Date October 30, 1978	
Subject	CRYSTAL ATTACH - PRE TRIM
POC 78-6579	

5.2

1.0 PURPOSE:

To attach crystal to substrate.

2.0 SAFETY:

Normal precautions used around hot soldering equipment.

3.0 EQUIPMENT:

- 3.1 Tweezer - #3C or equivalent
- 3.2 Wire Cutters
- 3.3 Flux - alpha 611 or equivalent
- 3.4 Soldering iron: 12 watt - with variac
- 3.5 Heat column (100°C +0) with vacuum hold-down  
-5
- 3.6 Variac for heat column
- 3.7 Microscope - B&L 7X to 30X Stueozovm or equivalent
- 3.8 60/40 solder
- 3.9 Beaker filled with Genesolve DTA
- 3.10 Stiff Flux brush
- 3.11 Crystals

4.0 PRODUCT REQUIREMENTS:

- 4.1 A good solder joint should exhibit a smooth hard surface with a bright metallic luster and the edges should feather out to a thin line.
- 4.2 Solder shall wet the entire surface of the crystal lead contiguous to the solder pad area. The sides of the crystal lead shall have a smooth fillet of solder. Solder shall extend over the top of the crystal lead and shall cover at least 50% of the lead which extends over the solder pad area.

5.0 PROCESS REQUIREMENTS:

- 5.1 Cut crystal leads to length of approx. 1/2 inch.
- 5.2 Place substrate on heat column.
- 5.3 Dip crystal elads into flux.
- 5.4 With crystal leads parallel to substrate and located over mounting pads, apply solder with hot iron being sure to have a sufficient solder joint as per para. 4.0 above.
- 5.5 Remove substrate from heat column.
- 5.6 After substrate has cooled down, clean solder joints by dipping the flux brush into the beaker of Genesolve DTA and brushing vigorously over pads, being very careful not to damage wire bonds internal to the corral area.



Operation Standard		1758
Sheet	1	Rev. 0
Date October 30, 1978		
POC 78-6579		

**Subject**

## POTENTIOMETER AND CRYSTAL MOUNTING

POC 78-6579

To mount potentiometer and crystal onto sealed VCXO module.

Polyethelene gloves should be worn on both hands since skin can become sensitized when in repeated contact with epoxy.

```

3.1 Potentiometer alignment jig
3.2 #4 Boston clips
3.3 crystals
3.4 potentiometers
3.5 1 - 7cc tube Ablestick 293-1 epoxy
3.6 100°C +0 oven
      -5
3.7 2 - 12" X 18" metal cookie trays
3.8 Degreaser - genesolve DTA
3.9 Mesh basket for degreaser
3.10 1 pr. #3C tweezers
3.11 Metal spacer - part #31871-1
3.12 Wire cutters
3.13 #26 gauge teflon coated copper wire
3.14 60/40 solder
3.15 Alpha 611 flux
3.16 Artist brush
3.17 Hot wire stripper
3.18 17 watt soldering iron with variac

```

- 4.1 Clean all modules by placing in mesh basket and placing in clean side of degreaser for 30 seconds. Remove and spray with wand for 30 seconds.
- 4.2 Remove modules from basket and place in clean metal tray to dry.
- 4.3 Remove 293-1 epoxy from freezer and allow to thaw for approximately 5 minutes.

[illegible]



# RAYTHEON COMPANY

Operation Standard 1758	
Sheet 2	Rev. 0
Date October 30, 1978	
Subject POTENTIOMETER AND CRYSTAL MOUNTING	POC 78-6579

## 4.0 PROCESS REQUIREMENTS: Cont.

- 4.4 Place sealed VCXO module on alignment jig so that the substrate sits in the slot with the leads facing the front of the fixture. The back of the substrate should sit flush against the back of the fixture.
- 4.5 Squeeze a drop of epoxy onto the bottom side of the potentiometer.
- 4.6 Place the potentiometer towards the rear of the cover so that the potentiometer cap lines up and sits into the hole in the fixture. Once in place, press the potentiometer down into place.
- 4.7 When aligned, be sure that the back of substrate is still flush against the back of the fixture.
- 4.8 Carefully slide the module out of the fixture.
- 4.9 Holding the module horizontally in one hand, carefully place a clip over the potentiometer to hold it in place. Be very careful to insure that the potentiometer doesn't move when the clip is put on.
- 4.10 Squeeze a drop of epoxy onto the back side of a metal spacer. (Note: If -1 oval crystal is to be used on the module, no spacer is needed).
- 4.11 On the cover, on the front side of the module, mount the metal spacer so that it is approximately 0.125 inch away from the front edge of the cover. Use the measuring guide to set this distance. The tapered edges of the spacer should be face up and flush with the side edges of the cover. When the spacer is aligned, press down so that it sets into epoxy.
- 4.12 There are two different kinds of spacers for different crystals - one spacer has a hole in it, the other does not.
- 4.13 If the crystal to be mounted is in a round, T05 can (-4) place a small dot of epoxy on the top of the can and place top-down into the hole in the spacer so that the leads are up. The crystal should be mounted so that the two leads are parallel to the front of the cover. Press into place, being sure not to move the spacer.
- 4.14 Place a clamp over the crystal to hold it in place .
- 4.15 If the crystal to be mounted is in a ceramic flat-pack, (-3), place a small dot of epoxy onto the flat side (without a number), and center it onto the spacer with the two leads facing the front. Press into place, being sure not to move spacer.



## RAYTHEON COMPANY

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Subject	POTENTIOMETER AND CRYSTAL MOUNTING	POC 78-6579	

4.0 PROCESS REQUIREMENTS: Cont.

- 4.16 Place a clamp over the crystal to hold it in place.
- 4.17 After all units are completed, place in metal cookie sheet and place in  $100^{\circ}\text{C} +0$  oven for 2 hours minimum.  
-5
- 4.18 Remove from oven and remove clips from modules.
- 4.19 Inspect for proper alignment of crystal and potentiometer.
- 4.20 Cut crystal and potentiometer leads to approximately 0.100 inch with wire cutters.
- 4.21 Pre-cut 100 lengths of teflon coated wire to approximately 1.25 inches and strip both ends with wire strippers.
- 4.22 Solder a wire lead to pins 1 and 2 of potentiometer - no connection is made to pin 3.
- 4.23 Place module on vacuum hot plate  $100^{\circ}\text{C} +0$   
-10
- 4.24 Solder pin 1 of potentiometer to pin 10 of module. Be sure to solder to inner pad of pin 10 which is silver in color.
- 4.25 Solder pin 2 of potentiometer to pin 6 of module. Be sure to solder to inner pad of pin 6 which is silver in color.
- 4.26 For flat-pack crystals, pre-cut 100 lengths of teflon coated wire to approximately one half inch and strip both ends with wire strippers.
- 4.27 Solder a wire lead to both leads of the crystal.
- 4.28 Place module onto hot plate  $100^{\circ}\text{C} +0$   
-10.
- 4.29 Solder the other end of leads to pins 8 and 9 of the module. Be sure to solder to the inner pads of pins 8 and 9 which are silver in color.
- 4.30 Remove module from hot plate.
- 4.31 When cool, swish around module in beaker of genesolve DTA.





RAYTHEON COMPANY

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Date	October 30, 1978
Subject	POTENTIOMETER AND CRYSTAL MOUNTING
	POC 78-6579

4.0 PROCESS REQUIREMENTS: Cont.

- 4.32 When all modules are complete, place in mesh basket and spray with wand in degreaser for 30 seconds. Then place in clean side for 1 minute and vapor for 1 minute.
- 4.33 Inspect modules for complete flux removal and for proper solder joints.



Form 20-0044

**RAYTHEON COMPANY**

Operation Standard		1759
Sheet 1	Rev. 0	
Date October 24, 1978		
POC 78-6579		

5.2

1.0 PURPOSE:

To mate a TCFG and VCXO module back to back electrically and physically, to form a completed TCVCXO module.

## 2.0 SAFETY:

Normal precautions used around hot soldering equipment.

### 3.0 EQUIPMENT AND TOOLS:

- 3.1 1 pair #3C tweezers or equivalent
- 3.2 Wire cutters
- 3.3 Flux - alpha 611 or equivalent
- 3.4 40/60 solder
- 3.5 Beaker filled with genesolve DTA
- 3.6 Artists brush
- 3.7 Stiff brush
- 3.8 Work holding fixture - (PC board holder)
- 3.9 #4 Boston clips
- 3.10 Able-stick 293 - 1 epoxy
- 3.11 Copper - half hard strip - part # A201101-899
- 3.12 Microscope - B&L 7 X 30 X or equivalent
- 3.13 1 package wooden tooth picks
- 3.14 1 package Q-Tips
- 3.15 95°C +0 oven
- 5
- 3.16 Degreaser - genesolbe DTA
- 3.17 Ink eraser
- 3.18 100°C +0 hot plate with vacuum hold-down
- 10
- 3.19 17 watt fine tip soldering iron with variac
- 3.20 # 260 grit wet or dry sandpaper

#### 4.0 PROCESS REQUIREMENT (PART 1)

- 4.1 Erase small pads on rear side of both module types with ink eraser and brush off excess erasers.
- 4.2 Swish modules in beaker of genesolve DTA. Place on clean tray to dry.
- 4.3 Place substrate on hot plate and lightly pre-tin the pads previously erased using alpha 611 flux and 40/60 solder.

[illegible]



## RAYTHEON COMPANY

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Subject	TCFG - VCXO MARRIAGE		POC 78-6579

4.0 PROCESS REQUIREMENT: (PART 1) Cont.

- 4.4 When modules have cooled, clean them in a beaker of genesolve - then place on clean tray.
- 4.5 Pre - cut lengths of ribbon to about 0.140 inch long, (7 pieces used per module).
- 4.6 Place VCXO module in work holding fixture face up with large pads to the left and small, pre-tinned pad to the right.
- 4.7 Calling the top right hand pad pin 1, solder a pre-cut length of ribbon to this pad so that the ribbon edge sits flush with the corral, and the remainder of the ribbon overlaps the edge of the substrate. Use 40/60 solder with alpha 611 flux.
- 4.8 Solder one ribbon to pads 2 & 3 so that it bridges in between them and shorts the two together.
- 4.9 Solder ribbon to pads 4 thru 8 as in step 4.7.
- 4.10 Remove substrate from fixture and clean in beaker of genesolve.
- 4.11 Repeat steps 4.6 thru 4.10 until all VCXO's leave ribbon attached.
- 4.12 Match corresponding TCFG to VCXO by matching the crystal numbers branded on the back of each module. Placed matched pairs together.
- 4.13 Place TCFG substrate back to back with matched VCXO substrate previously soldered matching the small pads together.
- 4.14 With substrates back to back, using #3C tweezers, bend the ribbon wires soldered onto the VCXO substrate over and around to the corresponding adjacent pads on the TCFG side.
- 4.15 Carefully holding the mated substrates together, place them into the work holder with the TCFG side up, large pads to the left, small pads to the right.
- 4.16 Solder ribbon to corresponding pads using 40/60 solder and alpha 611 flux.
- 4.17 When all 7 ribbons have been attached, remove the module from holder and place on tray. Continue until remainder of lot has been completed.
- 4.18 When done, clean modules by swishing in beaker of genesolve and vigorously brushing leads with stiff brush. Then spray with wand in degreaser. Place modules in mesh basket and dip in clean side of degreaser for 1 minute than in vapor for 30 seconds.



# RAYTHEON COMPANY

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Subject	TCFG - VCXO MARRIAGE
---------	----------------------

## 4.0 PROCESS REQUIREMENT: (Part 1) Cont.

4.19 Inspect for any flux residue and solder shorts.

## 5.0 PROCESS REQUIREMENTS: (Part 2)

- 5.1 The following steps are performed after the previously mated modules have been burned in and tested O.K.
- 5.2 Clean modules in degreaser by placing in mesh basket and spraying with wand. Place in clean side for 30 seconds and in vapor for 30 seconds. Place in clean metal tray to dry.
- 5.3 Remove Able-stick 293-1 epoxy from freezer and allow approximately 5 minutes to thaw.
- 5.4 Gently "unfold" TCFG from VCXO to about a 30 degree angle.
- 5.5 Squeeze a bead of epoxy onto back side of either substrate and spread it thin over the entire substrate using a tooth pick.
- 5.6 Squeeze substrates together being sure all edges are flush. Wipe away excess epoxy from edges.
- 5.7 Clamp modules together using #4C Boston clips. Place on metal tray.
- 5.8 Place units in 95°C +0 oven for 1½ hours minimum.
- 5.9 Remove units and allow to cool. Remove clips and check for excess epoxy on edges and leads in which case modules are to be sanded with #260 grit wet or dry sand paper.



From '29-2044

6.2[illegible]



## RAYTHEON COMPANY

Form 20-0044

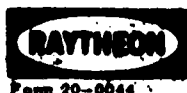
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Subject POTENTIOMETER ASSEMBLY		POC 78-6579	

## 4.0 PARTS PREPARATION: Cont.

- 4.2 Remove tetra-etch from freezer and set aside.
- 4.3 Fill one tin cup with asphalt. With artists brush, brush asphalt on inside of teflon cap being careful not to get any onto bottom lip of cap.
- 4.4 Put on safety glasses and ployathelene gloves.
- 4.5 When all caps are coated, place them in tin cup. Shake tetra-etch can vigorously for 1 minute - be sure cup is tightly closed.
- 4.6 Carefully open cover of tetra-etch and pour over caps being sure to cover them completely. Gently swish around for one minute until black solution turns whitish-brown.
- 4.7 Cover tetra-etch can tightly and put back in  $-40^{\circ}\text{C}$  freezer.
- 4.8 Carefully pour out excess liquid from tin cup being sure not to pour out any teflon caps.
- 4.9 Pour caps from tin cup to glass beaker.
- 4.10 Fill beaker approximately  $\frac{1}{4}$  full with water and swish around parts. Pour out water and repeat several times.
- 4.11 Drain water from beaker and fill  $\frac{1}{4}$  full with toluene. Swish around, drain and repeat.
- 4.12 Drain beaker and place parts on paper towel to dry.
- 4.13 Inspect parts - they should exhibit a brown-black color all around except for the inside which should remain white.

## 5.0 PROCESS REQUIREMENTS:

- 5.1 The epoxy must be stored at  $-40^{\circ}\text{C}$  or lower. Epoxy kept at room temp. for 24 hrs. or more is to be scrapped.
- 5.2 Load potentiometer onto loading rack with the three leads down into the slot.
- 5.3 Squeeze out about  $\frac{1}{4}$  tube ( $\frac{1}{4}\text{cc}$ ) of epoxy into tin cup.
- 5.4 Place entire rack of potentiometers under microscope.



# RAYTHEON COMPANY

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Subject  POTENTIOMETER ASSEMBLY		POC 78-6579

## 5.0 PROCESS REQUIREMENTS: Cont.

- 5.5 While viewing pot under microscope, use a needle to apply epoxy into the slot on adjusting screw of potentiometer. Be sure there is sufficient epoxy to cover the entire slot.
- 5.6 With a pair of #3C tweezers, pick up one dowel rod and place it into the previously epoxied slot, being sure to center the dowel and to firmly press it into slot.
- 5.7 After steps 5.5 and 5.6 have been completed for all pieces, place the entire rack of pots into the 125°C oven for 1 hr. minimum.
- 5.8 Remove rack from oven after time has elapsed.
- 5.9 With #3C tweezers, pick up one surface retainer and apply a small dot of epoxy (with needle) onto the middle of each inner side.
- 5.10 Place surface retainer onto corner of potentiometer closest to the adjusting screw so that the top of the retainer is flush to the top of the pot. Squeeze firmly into place and then clamp to hold with #4C Boston clamp. Be sure that no epoxy oozes out of the top (flush) side of the retainer, since this surface must be perfectly flat.
- 5.11 Place clamped unit onto cookie tray and when all units have been completed, put tray into 125°C oven for 1 hour.
- 5.12 Remove tray from oven and remove clips.
- 5.13 Place one coupler face down (open end down) onto flat surface. Slide teflon cap over coupler and push down until the cap and coupler are flush.
- 5.14 Place a small bead of epoxy around the bottom (flat edge) of the teflon cap being careful not to get any onto the coupler.
- 5.15 Place the coupler - cap assembly over the adjust screw and turn cap until the slot on the bottom of the coupler lines up over the dowel pin. Push coupler - cap assembly down so that it sits flush with the top of the pot.
- 5.16 Clamp down the coupler - cap assembly to the main body of the pot with a #4C Boston clip and place assembly onto a cookie sheet.
- 5.17 When all units have been completed, place the tray into the 125°C oven for 24 hours.



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Subject

POTENTIOMETER ASSEMBLY

5.0 PROCESS REQUIREMENTS: Cont.

5.18 Remove tray from oven and remove clips.

5.19 Inspect assemblies, looking for misaligned cups.

5.20 With a jewelers screwdriver, turn the set screw inside the teflon cup. If it does not turn, the assembly is no good and should be scrapped.





RAYTHEON COMPANY

Form 20-0044

Operation Standard	1761	
Sheet	1	Rev. 0
Date	October 18, 1978	
Subject	BURN IN PROCEDURE FOR ECOM MODULES H60388	
	POC 78-6564	

5.1

1.0 EQUIPMENT:

- 1.1 50 socket burn in tray drawing C78-59-E1.
- 1.2 Blue-M Burn in oven
- 1.3 Sorensen power type QRD15-2 or equivalent.

2.0 SET UP PROCEDURE:

- 2.1 Adjust power supply for +12.0V
- 2.2 Switch off power supply
- 2.3 Plug modules into tray making sure that each socket in the burn in tray is fitted with a fiber glass spacer. This spacer should be positioned to block off the two left side terminals looking at the front of the tray.
- 2.4 Slide burn in tray into slides in oven so that the rear connector on the tray is engaged in the oven socket.
- 2.5 Switch on 12V power supply and confirm voltage setting is correct by monitoring pin 5 on any of the module socket - back row left hand side looking at top of tray. Readjust if necessary.
- 2.6 Close up oven, set for 125°C and switch on.



Form 20-0044

**RAYTHEON COMPANY**

Operation Standard		1762
Sheet	1	Rev. 0
Date Feb. 19, 1979		
POC 79-6112		

5.3

**1.0 PURPOSE:**

The purpose of this instruction is to provide criteria for the inspection of TCVCXO modules. Para. 5.0 Pre-Pot. Para. 6.0 Final Q.C. Inspection.

2.0 FREQUENCY:

All (100%) modules shall be inspected.

### 3.0 EQUIPMENT:

10X magnification as required, calipers or spacers.

#### 4.0 PRE-INSPECTION PERUSAL:

Referring to the applicable assembly drawing check to assure that all components and connections are in their proper location. Check to assure that all bond media have been cured (soft or tacky epoxy is not acceptable). Components or wires may not appear damaged, seperated or broken.

## 5.0 PRE-POT INSPECTION CRITERIA:

5.1 Soldering criteria shall be as specified in paragraph 4.2.1 of O.S. 1265, except as modified in paragraphs below.

## 5.2 Spacing Requirements:

5.2.1 Potentiometer leads must be maintained at least .010" above case.

5.2.2 The end of the potentiometer shall be flush with the edge of the substrate within .005".

5.2.3 The potentiometer shall be positioned as per dimensions indicated on Assy. Drawing 31380.

5.2.4 With the module lying flat, the projection of the crystal and potentiometer wires shall not extend beyond the dielectric line printed on the terminals. (Drawing 31380)

5.2.5 Crystals shall be positioned as per dash number type with ref. to drawing 31380.

[illegible]



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Subject INSPECTION OF ECOM MODULES TCVCXO  
H60388

5.2 Spacing Requirements: Cont.

5.2.6 All crystals shall be centered with respect to the width of the substrate as per drawing 31380 dimensions.

5.2.7 Edges of back to back substrates shall be flush within .010".

5.2.8 A .005" spacing must be maintained between conductor terminals on the wrap-around end.

5.2.9 Crystal Mounting:

5.2.9.1 T05 type crystals must be mounted in the hole of the specified spacer with the leads parallel to the edge of substrate. Ref. Drawing 31380.

5.2.9.2 Ceramic type crystals must be mounted to spacer without hole. Ref. Drawing 31380.

5.2.9.3 Crystal-can type crystals shall be mounted to spacer without hole. Ref. Drawing 31380.

5.2.10 Miscellaneous:

5.2.10.1 There shall be no evidence of peeling blistered or cut metalization.

5.2.10.2 There shall be no epoxy on edge surfaces of substrate or extending on any lead surface.

5.2.10.3 Substrates must be free of chip outs or cracks as viewed under 10X magnification.

5.2.10.4 All crystal and potentiometer leads shall be insulated with a sleeve.

5.2.10.5 Solder on long terminals shall not extend beyond white dielectric line printed on the terminals.

5.2.10.6 The crystal number shall be indicated on the white label attached to the crystal and also scribed into the VCXO cover next to the potentiometer.

NOTE: This number also serves as the module serial number.

5.2.10.7 Covers may not appear dented, distorted or otherwise damaged.



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- 5.2.10 Miscellaneous: Cont.
- 5.2.10.8 Lot Traveler(s) to be filled out in full including revision level. Operation in/out total's must match or an explanation of rejects must be entered in the space provided.
- 5.2.10.9 A complete list of module serial numbers is to be written on the reverse side of the Lot Traveler. Any module which has been rejected, shall have the "Reason for Reject" indicated to the right of the serial number. If a rejected module is returned to the lot, it must be indicated as such next to the reason it was rejected.
- 5.2.10.10 Pre-pot test data sheets must accompany the lot. All sheets are to be filled out in full including Rev. Number, serial number of module, XTAL lot letter (If required), dash number, and TCVCXO lot number.

## 6.0 FINAL Q.C. INSPECTION:

- 6.1 The following items should be submitted as the lot package for final inspection:
  - 6.1.1 Pre-pot Test Data Sheets
  - 6.1.2 Final Test Data Sheets
  - 6.1.3 X-Rays of All Modules
  - 6.1.4 Lot Traveler - TCVCXO
  - 6.1.5 TCVCXO Modules
- 6.2 Inspect the lot traveler for proper data entry as follows:
  - 6.2.1 All operation blocks are to be filled out in full. This includes:
    - 6.2.1.1 Date's IN/OUT of the particular operation
    - 6.2.1.2 Number's of units IN/OUT of the particular operation. If the IN/OUT numbers do not match (i.e. 20/20, 14/14), an explanation must be filled in under the rejected items column. Also the modules affected must show an explanation next to its serial number on the reverse side of the Lot Traveler.
    - 6.2.1.3 The initials of the operator who performed the operation.
  - 6.2.2 Lot Number
  - 6.2.3 Type number and revision



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Subject

INSPECTION OF ECOM MODULES TCVCXO  
H603886.0 FINAL Q.C. INSPECTION: Cont.

- 6.2.4 The number of modules submitted for inspection must agree with the list of S/N's listed on the reverse side of the lot traveler.

## 6.3 Inspection Of Final Test Data Sheets:

- 6.3.1 Look over data sheets in general to insure all data has been entered. Insure entry of Rev. level, module (crystal) S/N, XTAL lot letter, dash number, and TCVCXO lot No. Also the date and initials of the test person.
- 6.3.2 Verify  $\Delta F$  temp. curve data entry under test number 10. The temp. range used for F min. and F max. data is -40 to +75°C. The center frequency (middle line of ink dots) is used for this data along with the  $F_{30}$  and  $F_{25}$  entries.
- 6.3.3 Verify the  $\Delta F$  computation (Test Number 11) on 10% of the modules submitted using the formula:

$$\Delta F = F_{30} - 1/2 (F \text{ max.} + F \text{ min.})$$

Example:

F max. +60 F min. -130  $F_{30}$  10  $F_{25}$  5

$$\Delta F = 10 - .5 (+60 + (-130))$$

$$\Delta F = 10 - .5 (-70)$$

$$\Delta F = 10 - (-35)$$

$$\Delta F = 10 + 35$$

$$\Delta F = +45$$

- 6.3.4 Verify the freq. deviation at 25°C setting by using the formula: (Perform on 10% of modules)

$$\Delta F + (F_{25} - F_{30}) = \text{_____} (\text{Deviation})$$

NOTE: This deviation freq. is used to allow calibration of the module at 25°C and yield the correct  $\Delta F$  at 30°C.

- 6.3.5 Test No. 12 should indicate the freq. at which the center frequency is to be adjusted (21,937,500 + answer to #11) at 25°C.



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6.0 FINAL Q.C. INSPECTION: Cont.

- 6.4 Inspect for the correct serial number and dash number on the module and data sheet by matching the module S/N's against the X-Rays. A dash -1 will show up rectangular in shape. A -3 either round (TO-5 Can) or square (ceramic).
- 6.5 Inspect for branding of correct  $\Delta F$  as per test #10 on the Final Data Sheet.
- 6.6 The entire brand package should be located as far to the right as possible and not to protrude more than .020" to the left of the "T" on the top of the module. Ref. Drawing 31865, Encapsulated Module TCVCXO.
- 6.7 Inspect for the presence of a red dot on the contact end of all dash 1 modules.
- 6.8 Inspect for module contact dimensions as per drawing 31865.
- 6.9 Insure the module end cap is positioned flush to the case.
- 6.10 The module should be free of excess RTV and stycast material. The module contacts should be clean and free of oxidation.
- 6.11 Perform a brand permanency test as follows:
  - 6.11.1 Dip a "Q" Tip into Freon TMC or Genesolve DTA and wipe across the brand several times. There should be no smearing or other degradation of the brand. Perform this on one module per lot.



RAYTHEON COMPANY

Form 10044

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5.2

1.0 PURPOSE:

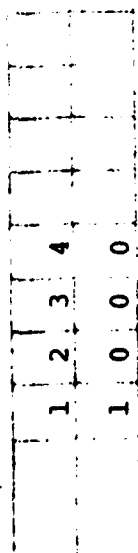
To encapsulate module

2.0 EQUIPMENT:

- 2.1 Lead length fixture
- 2.2 Loading fixture
- 2.3 Tongue depressure, large, small
- 2.4 Paper cups, 32oz., 4oz
- 2.5 Balance scale
- 2.6 Tapered round file (tapered up to 0.172" diam.)
- 2.7 15cc plastic syringe and plunger
- 2.8 Vacuum pump and bell jar
- 2.9 Forced air flow oven -  $80^{\circ}\text{C} \pm 5^{\circ}\text{C}$
- 2.10 Hysol mold release #3168
- 2.11 Hot knife
- 2.12 RTV 8111 & Catalyst
- 2.13 Stycast 1090 SI & 24LV catalyst
- 2.14 Degreaser with genesolve DTA
- 2.15 Mesh basket for degreaser
- 2.16 1 box #3 elastics
- 2.17 1 box Q-Tips
- 2.18 Beaker full of methalene-chloride
- 2.19 Stiff brush
- 2.20 Potting shells and covers

3.0 PROCEDURE:

- 3.1 Note crystal number on module and scratch this number on the back of the shell just above the "T" notch. Note that there are 3 different crystal types. If the crystal is oval, succeed the above # with an "V", If the crystal is a ceramic type, succeed the # with a "C", if the crystal is a TO5 type, succeed the # with a "T".
- 3.2 Slide module into shell and push as far back as it will go, being careful not to break shell.
- 3.3 Note position of potentiometer relative to it corresponding hole on the back side of the shell and remove module. If the potentiometer did not align with it hole, use the round file to increase the hole size. Re-insert the module to confirm that potentiometer now fits into hole.
- 3.4 Remove module from shell.
- 3.5 Repeat above procedure until entire lot of modules is completed.





## RAYTHEON COMPANY

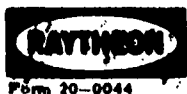
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3.0 PROCEDURE: Cont.

- 3.6 Place all shells, covers, and modules into a mesh basket and spray with wand in degreaser over the dirty side for 1 minute. Now place basket in clean side of degreaser and swish around for 1 minute. Remove basket and place in fumes for 30 seconds. Remove modules and shells from basket and place in clean metal tray.
- 3.7 Place each module back into its corresponding shell, being sure that the module is pushed all the way back.
- 3.8 Gently place slotted cover over the shell with the module leads coming out of the slot in the cover.
- 3.9 Hold the above assembly upside down so that the leads are facing downward, being careful to hold the cover on so it doesn't fall off.
- 3.10 Slide the assembly so that the leads fit into the slots on the lead length fixture and press firmly until the leads sit all the way down into the slot and until the top cover of the module sits flush against the top surface of the fixture.
- 3.11 To insure paper lead length, push the back side of the module (slowly thru the slot), downward until the leads sit all the way down into the slot, being careful that the cover has not moved.
- 3.12 Repeat steps 3.8 thru 3.11 until the entire lot has been loaded into the lead length fixture. (Each fixture will hold 10 modules).
- 3.13 Measure out 50 grams of RTV 8111 in 4 oz. cup and add 2.5 grams of catalyst. Mix well with tongue depressor until RTV is uniform in color.
- 3.14 With the modules still loaded in the lead length fixture, use a small tongue depressor and apply RTV into the hole and slot on the back side of the module being sure to fill both and being very careful not to move the module. Be careful not to get RTV on the sides of the shell or the shell will not fit into loading fixture.
- 3.15 While RTV is setting, dip loading fixtures into mold release solution and fill 4 oz. cup with mold release. Have Q-Tips handy.





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3.0 PROCEDURE: Cont.

- 3.16 If RTV has set, remove one module at a time carefully from lead length fixture and remove cover gently. With a Q-tip, swab around the entire outer surface of the shell with mold release, being careful not to get any mold release inside the shell or on the top lip where the cover is to be mounted.
- 3.17 Place module assembly into previously mold-released loading fixture, lead side up.
- 3.18 Repeat steps 3.16 and 3.17 until all modules are loaded.
- 3.19 Place modules into 80°C oven for 10 minutes minimum.
- 3.20 Measure out 100 grams of Stycast 1090 SI into a 32 oz. cup and measure out 23 grams of 24 LV catalyst in a 4 oz. cup. Add catalyst to resin and mix with tongue depressor for 1 minute - then mix with motorized mixer for 1 minute.
- 3.21 Place stycast mixture under vacuum bell jar and turn vacuum on full. Leave under vacuum for 5 minutes.
- 3.22 Release vacuum and remove stycast.
- 3.23 Load 15cc syringe approximately half full of stycast and push in plunger.
- 3.24 Remove modules from oven (from step 3.19).
- 3.25 Squirt stycast into each shelled module assembly, filling up each sell approx. half full. Reload syringe as needed.
- 3.26 After all units are half filled, discard remainder of stycast.
- 3.27 Place units under bell jar and turn on full vacuum. Leave for 5 minutes minimum.
- 3.28 Repeat steps 3.20 thru 3.23.
- 3.29 Shut off vacuum and remove modules.
- 3.30 With syringe, fill modules flush to top of shell with stycast.



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3.0 PROCEDURE: Cont.

- 3.31 Put on cover. If shell is filled properly, a slight amount of potting should ooze out of the "Fill" hole and around the edges of the cover. Wipe off this excess potting with a Q-tip dipped in methalene chloride.
- 3.32 After cover is placed on each module and module is cleaned with a Q-tip, carefully remove one module at a time and place 2 elastic band around module to hold the cover down. Place module back into loading fixture.
- 3.33 After all modules are covered and elastic bands are mounted, place them into 80°C oven for one hour.
- 3.34 When modules come out of the oven, use the hot knife to scrape off the excess potting on the case and leads.
- 3.35 Remove RTV from back side of module by "peeling" it off.
- 3.36 To clean the module, dip it in a beaker full of methalene chloride for at least one minute. Use a stiff brush to clean off excess potting missed in step 3.34 above.
- 3.37 Place all modules in a mesh basket and spray in degreaser over dirty side for 1 minute, then place in clean side for 30 seconds and in vapor for 30 seconds.
- 3.38 Remove modules from basket and inspect for workmanship. If there are any voids in the "fill" hole in the cover, patch them up by mixing a small quantity of Stycast and filling holes and repeating steps 3.33 to 3.37 (skip step 3.35).

**Subject**

## PROCEDURE FOR AGING ECOM MODULES

POC 78-6565

**IMPORTANT NOTE:**

It is essential that the temperature of the aging bath be 60°C to 0.1°C when frequency measurements are being made.

1.0 EQUIPMENT:

- 1.1 Rubidium frequency standard HP model 5065A or equivalent.
- 1.2 Blue N1 versa-whirl constant temperature bath model LTB-1-P200C.
- 1.3 Counter HP model 5345A or equivalent.
- 1.4 D.C. power supply sorrensen ORD 15-2 or equivalent.
- 1.5 Digital voltmeter HP3439 or equivalent.

## 2.0 ADJUSTMENTS PRIOR TO CONNECTING MODULES:

- 2.1 Confirm temperature of bath as indicated on its thermometer is  $60.0^{\circ}\text{C} \pm 0.1^{\circ}\text{C}$ . Adjust fine regulator at left rear corner of bath when necessary. Clockwise adjustment increases bath temperature. Counter clockwise lowers it. Resolution is approximately  $0.5^{\circ}\text{C}$  for one complete revolution of adjustment knob.
- 2.2 Adjust power supply control for 12.0V output monitoring voltage at wiring harness sockets on top of the bath. Use pin 5 of socket for + and pin 3 for -. Monitor with DVM.

### 3.0 CONNECTIONS OF MODULES:

- 3.1 Extract free end of umbilical cord from its glass enclosure in the temperature bath.
- 3.2 Switch off the 12V power supply.
- 3.3 Plug module into connector on umbilical cord making sure this connector has fiber glass spacer fitted into it.
- 3.4 Use a small piece of harnessing cord to tie module securely onto its socket.
- 3.5 Repeat for all modules to be used.
- 3.6 Insert each module into its appropriate glass enclosure in bath.

[illegible]



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	POC 78-6565	

4.0 TESTING MODULES IN AGING BATH:

- 4.1 Switch on +12V power supply.
- 4.2 Monitor pin 1 at each of the sockets in the wiring harness on the top of the bath which have modules connected to their umbilical cords with the DVM. Voltage must be  $9.0V \pm 0.1V$ .
- 4.3 Connect 5MHZ signal output from rubidium frequency standard to external frequency standard input BNC Jack at rear of counter.
- 4.4 Use counter to monitor each module frequency and record on Data Sheet together with its lot and serial number.
- 4.5 Repeat 4.4 every 24 hours during the aging cycle.

O.S. 1765  
Sh. 3 of 3

**READINGS TAKEN EVERY 24 HOURS**

[illegible]



RAYTHEON COMPANY

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POC 78-6640

## BRANDING OF TCVCXO

To define a process for applying and curing of branding ink to TCVCX0 final assembly.

- 2.1 Hand stamp, Pullman XCPN - 009 or equivalent
- 2.2 Flat rubber stamp pad made according to print #32561
- 2.3 Plate glass of convenient size (at least 1 foot sq.), mounted on table top.
- 2.4 Standard rojafix ink roller
- 2.5 Raytheon Ink, Red #ZZ10-2 (303450-5)
- 2.6 Raytheon Ink, White #ZZ10-9 (303450-19)
- 2.7 Morkem #320 cleaner
- 2.8 Lint-free cloth
- 2.9 100°C +0 oven  
-5
- 2.10 Double sided stick tape
- 2.11 Finger cots
- 2.12 Metal cookie sheet - 12 X 18 inches

- 3.1 Operator must wear finger cots while cleaning and branding.
- 3.2 Using a clean, lint-free cloth, wipe surface to be branded with morkem #320 cleaner.
- 3.3 After cleaner has evaporated, repeat step 3.2 with clean cloth.
- 3.4 Modules should be branded soon after cleaner evaporates.

[illegible]



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Subject	BRANDING OF TCVCX0		POC 78-6640

#### 4.0 APPLICATION OF BRAND:

- 4.1 Apply double - sided stick tape to back side of rubber stamp and stick stamp onto glass table top.
- 4.2 Place a small amount of ink onto the glass plate and roll to an even layer.
- 4.3 After rolling over the ink with roller, roll over the rubber stamp, being sure to cover all numbers uniformly with ink. If coverage is not uniform, wipe stamp with cloth wet with markem cleaner and re-roll with ink.
- 4.4 Grasp TCVCX0 module with both hands and roll it over the rubber stamp so that the brand is oriented as shown on the final assembly print #31865-2.
- 4.5 If, after rolling, the brand is too thick or mis-oriented, wipe it off with a cloth wet with markem cleaner and re-brand after cleaner evaporates.
- 4.6 Using a Pullman XCPN - 009 hand stamp, or equivalent, stamp in date code, type number (-1 or -3) and serial number. Note: If module is a type -1, the -1 is to be branded in red along with a red dot on the rear of the module as shown on print #31865-2.
- 4.7 After all modules are complete, place on a clean metal cookie sheet and place in a 100°C +0 oven for 2 hours minimum.
- 4.8 Modules are now ready to submit to Final Test.
- 4.9 After modules have been final tested, a sheet of "deltas" will be submitted with the lot to the brander. Brand the delta to the corresponding module in the space provided. (See print #31865-2)
- 4.10 Cure as in step 4.7.
- 4.11 All branding is now completed and modules should be submitted to Q.C. for inspection.

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